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Jc952 U.S. PTO

**UTILITY PATENT APPLICATION TRANSMITTAL  
(Large Entity)**

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.  
06558/007002

Total Pages in this Submission

Jc943 U.S. PTO

09/24/00

11/28/00

**TO THE ASSISTANT COMMISSIONER FOR PATENTS**Box Patent Application  
Washington, D.C. 20231

Transmitted herewith for filing under 35 U.S.C. 111(a) and 37 C.F.R. 1.53(b) is a new utility patent application for an invention entitled:

**INFORMATION MANAGEMENT SYSTEM**

and invented by:

**Dexter A. BURLEIGH, Dominique BERTA, and Jerry C. PHILLIPS**If a **CONTINUATION APPLICATION**, check appropriate box and supply the requisite information:☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: \_\_\_\_\_

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Enclosed are:

**Application Elements**

1. ☐ Filing fee as calculated and transmitted as described below
2. ☒ Specification having 49 pages and including the following:
  - a. ☒ Descriptive Title of the Invention
  - b. ☒ Cross References to Related Applications (if applicable)
  - c. ☐ Statement Regarding Federally-sponsored Research/Development (if applicable)
  - d. ☐ Reference to Microfiche Appendix (if applicable)
  - e. ☒ Background of the Invention
  - f. ☒ Brief Summary of the Invention
  - g. ☒ Brief Description of the Drawings (if drawings filed)
  - h. ☒ Detailed Description
  - i. ☒ Claim(s) as Classified Below
  - j. ☒ Abstract of the Disclosure

**22511**

PATENT TRADEMARK OFFICE

# UTILITY PATENT APPLICATION TRANSMITTAL (Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.  
06558/007002

Total Pages in this Submission

## Application Elements (Continued)

3. ☒ Drawing(s) (when necessary as prescribed by 35 USC 113)
- a. ☐ Formal Number of Sheets \_\_\_\_\_
- b. ☒ Informal Number of Sheets 17
4. ☒ Oath or Declaration
- a. ☐ Newly executed (original or copy) ☒ Unexecuted
- b. ☐ Copy from a prior application (37 CFR 1.63(d)) (for continuation/divisional application only)
- c. ☒ With Power of Attorney ☐ Without Power of Attorney
- d. ☐ DELETION OF INVENTOR(S)  
Signed statement attached deleting inventor(s) named in the prior application,  
see 37 C.F.R. 1.63(d)(2) and 1.33(b).
5. ☐ Incorporation By Reference (usable if Box 4b is checked)  
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. ☐ Computer Program in Microfiche (Appendix)
7. ☐ Nucleotide and/or Amino Acid Sequence Submission (if applicable, all must be included)
- a. ☐ Paper Copy
- b. ☐ Computer Readable Copy (identical to computer copy)
- c. ☐ Statement Verifying Identical Paper and Computer Readable Copy

## Accompanying Application Parts

8. ☐ Assignment Papers (cover sheet & document(s))
9. ☐ 37 CFR 3.73(B) Statement (when there is an assignee)
10. ☐ English Translation Document (if applicable)
11. ☐ Information Disclosure Statement/PTO-1449 ☐ Copies of IDS Citations
12. ☐ Preliminary Amendment
13. ☒ Acknowledgment postcard
14. ☒ Certificate of Mailing
- ☐ First Class ☒ Express Mail (Specify Label No.): EL656800405US

**UTILITY PATENT APPLICATION TRANSMITTAL**  
**(Large Entity)**

*(Only for new nonprovisional applications under 37 CFR 1.53(b))*

Docket No.  
06558/007002

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**Accompanying Application Parts (Continued)**

15. ☐ Certified Copy of Priority Document(s) *(if foreign priority is claimed)*
16. ☐ Additional Enclosures *(please identify below):*

**Request That Application Not Be Published Pursuant To 35 U.S.C. 122(b)(2)**

17. ☐ Pursuant to 35 U.S.C. 122(b)(2), Applicant hereby requests that this patent application not be published pursuant to 35 U.S.C. 122(b)(1). Applicant hereby certifies that the invention disclosed in this application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication of applications 18 months after filing of the application.

***Warning***

***An applicant who makes a request not to publish, but who subsequently files in a foreign country or under a multilateral international agreement specified in 35 U.S.C. 122(b)(2)(B)(i), must notify the Director of such filing not later than 45 days after the date of the filing of such foreign or international application. A failure of the applicant to provide such notice within the prescribed period shall result in the application being regarded as abandoned, unless it is shown to the satisfaction of the Director that the delay in submitting the notice was unintentional.***

**UTILITY PATENT APPLICATION TRANSMITTAL**  
**(Large Entity)**

(Only for new nonprovisional applications under 37 CFR 1.53(b))

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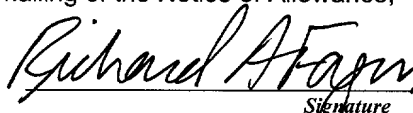
**Fee Calculation and Transmittal**

**CLAIMS AS FILED**

For	#Filed	#Allowed	#Extra	Rate	Fee
Total Claims	40	- 20 =	20	x \$18.00	\$360.00
Indep. Claims	4	- 3 =	1	x \$80.00	\$80.00
Multiple Dependent Claims (check if applicable) <input type="checkbox"/>					\$0.00
BASIC FEE					\$710.00
OTHER FEE (specify purpose) _____					\$0.00
TOTAL FILING FEE					\$1,150.00

\*\*\*FILING FEES DEFERRED\*\*\*

- ☐ A check in the amount of \_\_\_\_\_ to cover the filing fee is enclosed.
- ☒ The Commissioner is hereby authorized to charge and credit Deposit Account No. **50-0591** as described below. A duplicate copy of this sheet is enclosed.
- ☐ Charge the amount of \_\_\_\_\_ as filing fee.
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- ☐ Charge any additional filing fees required under 37 C.F.R. 1.16 and 1.17.
- ☐ Charge the issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance, pursuant to 37 C.F.R. 1.311(b).

  
Signature

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CC:

**APPLICATION**  
**FOR**  
**UNITED STATES LETTERS PATENT**

**TITLE:            INFORMATION MANAGEMENT SYSTEM**

**APPLICANTS:   Dexter A. BURLEIGH, Dominique BERTA,  
                     and Jerry C. PHILLIPS**



**22511**

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"EXPRESS MAIL" Mailing Label Number: EL656800405US  
Date of Deposit: November 28, 2000

## INFORMATION MANAGEMENT SYSTEM

### CROSS REFERENCE TO RELATED APPLICATIONS

This application claims priority under Section 119 of U.S. Provisional Application No. 60/235,539, filed on September 26, 2000.

### FIELD OF THE INVENTION

5       The invention relates to the management of data used by more than one software application in a computer network environment. More specifically, the invention provides a system and method for managing information relevant to a petroleum portfolio. In particular, the invention provides a database management system that integrates information and data from a large cross-section of technical,  
10   financial, land operation, and regulatory functions for managing petroleum producing assets.

### BACKGROUND OF THE INVENTION

The flow of information between individuals responsible for various technical and/or administrative functions within an organization is typically  
15   facilitated by weekly or monthly meetings, email communications, and through individual conversations. As a result, the flow of information for an individual in the organization will typically include: (1) collecting relevant information 10 generated by other individuals having related job functions; (2) generating information 12 relevant to a respective job function; (3) generating a report 14  
20   summarizing respective information generated; and (4) meeting with other

individuals 16 to report or transfer information. This type of information flow scheme is illustrated in Figure 1.

For organizations comprising many individuals which generate information pertinent to defining, developing, and/or managing the organization's business or portfolio, the above described information flow methods can be extremely time consuming and difficult to coordinate. As a result, the use of these information flow methods can result in the ineffective management or mismanagement of the assets and portfolio of the organization. Therefore, a new method and system are needed for managing information generated by numerous individuals, typically using a plurality of application tools.

One example of this need is in coordinating petroleum operations, wherein it is important that each person in an asset development team has access to the most current information from not only his or her area but from all members of the team. Functions related to defining and developing a hydrocarbon-producing portfolio are typically separated into groups, referred to as functional groups. Each functional group comprises one or more individuals responsible for particular technical and/or administrative functions related to the development and management of the portfolio. The timely and accurate flow of information between these groups is important to efficient operations. Prior art business flow between these groups in the petroleum industry is based on paper data or electronic spreadsheets generated by individuals for their own use and located in various folders and drives on different computer systems. As a result, frequent business meetings are usually required to transfer this information between persons who perform the various business functions involved in the operation of the assets in the portfolio. At these meetings the various individuals typically

discuss the status of their work while the other professionals note aspects of the reports that affected their functions and the duties they performed. This type of environment creates communication problems and is dependent upon human rapport and availability.

5           Other types of data flow known in the art include having individuals fill out selected forms used by various departments within the organization operating the portfolio. For example, the individuals may include Geologists and Geophysicists who generate drilling prospects, Regulatory and Right-of-Way professionals who ensure compliance with laws and regulations affecting the operation, Landmen  
10   who ensure that lease obligations are met by drilling prospects and existing wells, Drilling engineers who design wells to be drilled on the prospects, Financial Analysts who plan budgets for asset development, and Managers who decide how best to allocate financial resources to develop assets according to the organization's financial goals.

15           In large operations, such as those that involve the drilling of large numbers of wells for fixed resources (limited number of rigs, limited budgets, other capital limitations) in a certain time frame, efficiency of time, equipment use and resources is important. In this type of environment, the traditional method of conducting meetings to discuss the status of several wells can be inefficient and  
20   difficult to coordinate because mutually agreeable times must be found when everyone involved in the operation can meet. Further, the effectiveness of such meetings is largely based on human rapport. Additionally, meetings involving several operations can be time consuming, in that time is spent discussing issues which relate to only a few individuals, having each person to present reports, and  
25   answering questions from one or two individuals in a group setting. In many



cases, these meetings consume valuable time that could have been better spent working in the office or field.

Prior art tools used in this type of environment typically include a number of specific application programs that are used by the various individuals in the asset development organization. Each of the applications is typically specific to an individual's role and function. For example, Geologists and Geophysicists have applications for interpreting 3-dimensional seismic surveys, and for indicating prospects thereon generated as a result of the interpretation. Reservoir Engineers have applications available which provide well test analysis and production forecasting. Drilling Engineers have available well design tools which facilitate design of wells to be drilled given formation parameters and depths to selected targets. Landmen have available applications which facilitate tracking of petroleum lease obligations, to make it easier to ensure that all obligations have been accounted for in the organization's business activity. These are not meant to be an exhaustive list of applications and their users in petroleum organizations, but are provided only to illustrate the complexity of asset development organizations.

A limitation of the applications known in the art is that each generates unique data sets. Most of the applications known in the art do not provide any facility for data generated by one application to be used in any other application other than by manual entry such as by keyboard, manually operated download or other non-automatic device. Therefore there is a need for a system and method which provide automatic update of data commonly used in a number of different applications across an organization in order to reduce the need to repetitively enter data, or provide other forms of manual data transfer.

### SUMMARY OF THE INVENTION

In one aspect, the invention provides an information and knowledge management system. The system includes a data repository adapted to store related data tied to a key parameter field and at least one application server adapted to provide a plurality of applications to a plurality of different users. The application server is operatively coupled to the data repository. Each of the applications is adapted to generate at least some data having the key parameter field. The application server is adapted to retrieve and update selected ones of the related data when any one of the applications uses and generates application data having the key parameter field.

In another aspect, the invention provides a management system for a portfolio of hydrocarbon-producing opportunities. This system includes at least one server adapted to serve a plurality of applications to respective users. Each of the applications is adapted to generate data corresponding to the respective user. At least some of the data generated by each application has a key parameter field therein. The system further includes a database management system (DBMS) operatively coupled to the at least one server. The database management system is adapted to store at least some of the data generated by each application and update any of the stored data having the key parameter field. The at least one server is adapted to serve the updated data to any other applications when the other applications retrieve the updated data having the key parameter field. Additionally, the system includes at least one business process model application adapted to apply a business process model to selected ones of the stored data to generate modeled data having the key parameter field. The at least business process model application is adapted to automatically update the modeled data

when selected ones of the stored data are updated by operation of any of the other applications.

In another aspect, the invention provides a method for managing information and business unit knowledge. The method includes serving a plurality  
5 of applications to respective users, wherein each application generates data corresponding thereto. At least some of the data generated includes a key parameter field. The method further includes storing the data generated by each application and updating any of the data having the key parameter field when one  
10 of the applications is used to modify any of the data having the key parameter field. The method additionally includes serving the updated data to any other one of the applications when the other one of the applications retrieves from storage the data having the key parameter field.

In another aspect, the invention provides a method for managing a portfolio of hydrocarbon-producing opportunities. The method includes having a plurality  
15 of functional groups each using an application related to the function of each of the functional groups, wherein each application generates data relevant thereto. The method further includes automatically updating corresponding data in any other ones of the applications based on the data generated by using one of the applications. The asset team members include at least two selected from  
20 Geoscientists, Landmen, Reservoir Engineers, Production Engineers, Facility Engineers, Regulatory Compliance Administrators, Right-of-Way Administrators, Material and Logistics Specialists, Drilling Engineers, Completion Engineers, Finance Analysts, Field Operators, Sales and Marketing Representatives, and Portfolio Managers.

Other aspects and advantages of the invention will become apparent from the description and claims which follow.

### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows one example of typical steps involved in the prior art information flow between individuals in an organization.

Figure 2 shows one example of the step involved in information flow between individuals in an organization in accordance with the present invention.

Figure 3 is an illustration of one embodiment of an information management system in accordance with the invention.

Figure 4 is an illustration of another embodiment of an information management system in accordance with the invention.

Figure 5 is an illustration of another embodiment of an information management system in accordance with the invention.

Figure 6 is an illustration of a database management system comprising a front-end user interface in accordance with one embodiment of the invention.

Figure 7 shows one illustration of one embodiment of the invention comprising a data storage manager (DSM), a portfolio management tool, and a portfolio forecast tool.

Figure 8A shows a flow chart for one embodiment of a method for managing information.

Figure 8B shows a flow chart for another embodiment of a method for managing information.

Figure 9 is an illustration of one embodiment of a database management system comprising security and integrity features.

Figure 10 shows one example of simplified business flow between members of a hydrocarbon development asset team.

Figures 11 and 11A are illustrations of embodiments of an information management system used to manage information for a hydrocarbon-producing portfolio.

Figure 12 is an illustration of one embodiment of a high-level view of a data storage manager structure (DSM), illustrating the types of data that may be provided to the DSM.

Figure 13 is an illustration of key links which may be provided to and from the data storage manager for one embodiment of the invention.

Figure 14 illustrates the link and data flow between the ProCast system and the data storage manager for one embodiment of the invention.

Figure 15 is an illustration of the business flow for one embodiment of the Optimizer system.

Figure 16 is an illustration of one embodiment of the invention, wherein applications known as Optimizer and ProCast seamlessly linked to DSM manage and process information for a hydrocarbon-producing portfolio.

Figure 17 is an illustration of one example of how the Optimizer can be used to streamline the portfolio management process.

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## DETAILED DESCRIPTION

To facilitate an understanding of the invention, the invention will now be described with reference to particular embodiments and an example of implementation and use for managing information and knowledge for a portfolio of hydrocarbon-producing opportunities. From the description, it will be apparent

to those skilled in the art that the practical applications of the invention are not limited to these particular embodiments. Rather, the principles of the invention are applicable to managing any type of information and knowledge and may be implemented using any type of computer network scheme, including terminal  
5 server environment, local-area networks (LANs), wide-area networks (WANs), the Internet, intranets, or any combination thereof.

The invention provides a system and method wherein information generated by one user's application is automatically provided as input into another user's application. Using the invention, an individual may only be required to  
10 generate data in order for that data to be transferred or made readily available to other individuals throughout the organization. Thus, as illustrated for example in Figure 2, an individual may use his respective software application to generate data **20**. This may include downloading relevant data **22** generated by others from a common data repository, generating related data, and then uploading newly  
15 generated data **24** to the common data repository, thereby making it readily available to others.

Referring to Figures 3-5, in accordance with one aspect of the invention, an information and knowledge management system comprises a data repository **30** adapted to store related data tied to a key parameter field, and an application  
20 server **32** adapted to provide a plurality of applications **34** to a plurality of different users **36**. The application server is operatively coupled to the data repository **30**. Each of the applications **34** is adapted to generate at least some data having the key parameter field. The application server **32** is adapted to retrieve and update selected ones of the related data when ones of the applications **34** are  
25 used to generate data having the key parameter field. In some embodiments, this

retrieval and/or update may occur automatically. The data repository **30** may be adapted to store all data generated by each of the applications **34** or only selective data generated by the application **34**. Additionally, the data repository **30** may comprise a single database or a plurality of databases wherein each of the plurality of databases is adapted to store data from one or more respective applications, as illustrated in Figure 5.

The server **32** may comprise a single application server, or a plurality of servers operatively connected to the data repository **30**. For example, the plurality of applications **34** may reside on the same server **32**, as shown in Figure 3 and Figure 4, or on a plurality of servers each server being accessible to one or more users **36** and operatively connected to the data repository **30** such that data can be communicated between the plurality of applications **34** and the data repository **30**. Additionally, the data repository **30** may be located on the same server **32** as one or more applications **34** as shown in Figure 3, or at a different location and in communication with the server **32** and applications **34**, as illustrated, for example, in Figure 4 and Figure 5. It should also be understood that in some embodiments, such as the ones illustrated in Figure 4 and Figure 5, users **36** may have access to other user's applications **34** or may share applications **34** without departing from the spirit of the invention.

In one embodiment, the related data stored in the data repository **30** may comprise data (data, work product, information, etc.) relevant to assets and/or opportunities in a portfolio. In this case, the plurality of users **36** may comprise different members of an asset development team responsible for different aspects of developing assets and/or opportunities in the portfolio and, thus, the generation of different data relevant to the portfolio. The data pertaining to each

asset/opportunity in the portfolio is, preferably, stored in a distinct record or set of records linked or tied together by key parameter fields. A unique key parameter field is, preferably, used to distinguish asset/opportunity records from each other. For example, all data related to a particular asset may be linked to a unique asset  
5 identification code which can be referenced to retrieve or update data related to that particular asset.

Members of the asset development team may use different applications 34 to generate their individual work product. For example, an accountant may use an accounting application specific to his job function, and a marketing representative  
10 may use a forecast application specific to his job function. In order for data generated by each application to be properly stored in the data repository 30, data generated should include an “identifier” or “tag” indicating which asset/opportunity or record the data corresponds to, so that the data can be linked to the appropriate record in the data repository 30. A key parameter field may be  
15 included in the data as a “tag” by the application 34 when generated or may be added to the data by another application after being generated. For example, data may be generated by an application 34 and stored in a data file corresponding to that application 34. Then, another application 34 may be used, such as one or more database management applications, to extract data from the data file, assign  
20 it a key parameter field, and then, based on the assigned key parameter field, store it in the data repository 30 properly linked to its related data.

As shown in Figure 7, in one embodiment, the plurality of applications 34 provided to users may comprise, for example, a database management application 47 (as part of a database management system (DBMS) 38), a portfolio  
25 management application 40, and a portfolio forecast application 42. Referring to



Figure 6, the database management application 47 may comprise part of a database management system 38 which includes a front-end user interface 44 operatively coupled to the data repository 30 and adapted to generate data having a key parameter field for storage in the data repository 30. The front-end user interface 44 may comprise a single application 46 or a plurality of different applications 46, each directed to particular users 36, such as particular members on an asset development team having particular job functions resulting in the generation of portfolio relevant data. Alternatively, the database management application 47 may link to other applications to extract data generated by the other applications.

As illustrated in Figure 9, the database management system 38, preferably, comprises means for maintaining data repository security 58 to ensure that unauthorized users do not gain access to the data in the data repository 30. For example, the application(s) comprising the front-end user interface (44 in Figure 6) may require usernames and passwords which match authorized user profiles before permitting access to the data in the data repository 30.

As further illustrated in Figure 9, the database management system 38 may also comprise means for ensuring or maintaining data integrity 60. For example, the user profiles may include indication of each user's function (e.g., technical or administrative function), which may be used to restrict users 36 from altering data outside of their assigned function, thereby insuring data integrity. Data integrity may also be ensured by embedding within the system "business process rules" 62 which may set boundaries for values of particular data that may be entered into different fields. For example, the system may not permit data values exceeding 100% to be stored as the amount of interest the organization has in a particular

asset. Additionally, business process rules **62** may be applied to automatically calculate certain data values based on values for related data and selected standard business formulas. For example, a business-standard formula may be used to automatically calculate estimated project costs based on equipment list data and standard cost tables to ensure the uniformity and integrity of estimated costs data throughout the organization.

Referring to Figure 7, the portfolio management application **40** may comprise a resource optimization tool **40** which uses data retrieved from the data repository **30** to generate an optimized allocation of resources based on one or more select criteria **48**. The criteria **48** may be embedded in the optimization tool **40** and selected by the user, or retrieved from storage. The selected criteria **48** may comprise, for example, capitalizing on or developing the most profitable properties or assets first, achieving a selected net cash flow, achieving a selected level of earnings, achieving a selected level of production, satisfying particular obligations on time, or developing assets to achieve the greatest net cash flow in a selected amount of time for a select amount of capital. Once a schedule indicating the optimized allocation of resources is generated, this schedule may be stored in the data repository (**30** in Figure 6) and made available for viewing by the selected users on the asset team so appropriate action can be taken to conform to the optimized schedule. This schedule may also be emailed or otherwise communicated to selected users so that immediate adjustments to resource allocations can be made, if needed.

The portfolio forecast application **42** may comprise a forecasting tool adapted to forecast future performance of assets based on past performance data and other related data. For example, given the proposed optimized resource

allocation schedule generated using the portfolio optimization tool **40**, industry forecasting techniques can be applied to the proposed schedule to predict resulting portfolio performance. For the particular example of predicting future production for a portfolio of hydrocarbon-producing opportunities, commercially available forecasting applications, such as forecasting software sold by Merak, Schlumberger Geoquest, or Landmark, may be used. The portfolio forecast application **42** may be used in combination with a portfolio resource optimization tool **40** to iteratively determine the portfolio resource allocation scenario resulting in the best predicted performance of the portfolio for the given selected criteria **48**.

Advantageously, providing an information management system which dynamically captures portfolio relevant data generated by asset team members and makes it commonly accessible to other team members as well as to other portfolio management tools can significantly streamline information flow in an organization and increase the effective management of the organization's portfolio.

Referring to Figure 8A, in accordance with another aspect of the invention, a method for managing information comprises serving **50** a plurality of applications to respective users, wherein each of the applications is used by the respective user to generate data corresponding to that respective user's job function. At least some of the data generated by each of the applications includes or is tied to a key parameter field. The method further comprises storing **52** the data generated by each application in a data repository **30** and updating **54** any of the data having the key parameter field when one of the applications is used to modify any of the stored data having the key parameter field. The method additionally includes serving **56** the updated data to any of the other applications when one of the other applications retrieves data having the key parameter field

from storage. As illustrated in Figure 8B, additionally, this method may further comprise applying **51** at least one business process model to data including at least some of the stored data having the key parameter field, and updating **52a** business model data when any of the stored data are updated by operation of any one of the  
5 applications.

Serving **50** a plurality of applications to respective users may include facilitating user access to a plurality of applications, such as by providing access to application software or software which can be used to interface with one or more applications. Serving **50** a plurality of applications may also include providing  
10 access to hardware which can be used to access one or more software applications. Serving **50** a plurality of applications may also include providing a user network, such as a local-area network, wide-area network, access to a global network, or other type of network wherein one or more users can access one or more applications through the network. Serving **50** a plurality of applications may also  
15 include providing an applications server which presents web pages to respective Internet connected users.

In accordance with the above aspects of the invention, data transfer or information flow between users is facilitated by providing a system which takes data generated by one application and provides it as input into one or more of the  
20 other applications. The system may also include a notification feature which can be used to notify users when newly generated information is available for their access and use. Advantageously, this type of information transfer allows data to be transferred substantially instantaneously, eliminating the need for generating data reports, arranging meetings to facilitate data transfer, or relying on other data  
25 transfer methods which are highly susceptible to human error and dependent upon

human intervention. Further, facilitating the transfer of data between applications ensures that accurate and current data is available for running other applications, such as business analysis applications, for generating monthly reports, and for making major business decisions. Further, providing for the communication of related data between user applications eliminates the potential for errors resulting from manual data re-entry, since the information needs only to be keyed in once for distribution to other applications and through the organization. This type of information management system also eliminates confusion regarding project status and data locations when users originally responsible for such projects leave an organization or cannot be reached for an extended period of time.

To further illustrate aspects of the invention, an example of the invention used to manage information for a hydrocarbon-producing portfolio is discussed in detail below.

*Managing Information for a Hydrocarbon-producing & Opportunities Portfolio*

In one example, the hydrocarbon-producing portfolio comprises existing and prospective hydrocarbon-producing wells and properties. The prospective wells include both current prospects (ones having approved drilling locations) as well as potential prospects. The information to be managed includes portfolio relevant data and related work product (generally referred to as data) for each of the wells and properties of the hydrocarbon-producing portfolio, as well as other information (cost tables, economic indicators, etc.) relevant to defining, developing, and managing the portfolio. Portfolio relevant data may include, for example, any data relevant to the development of assets in the portfolio, such as existing and proposed well locations, corresponding lease obligations, capital

equipment at well locations, and estimated hydrocarbon reserves in reservoirs penetrated by existing and prospective wells.

As noted in the Background section, the functions related to defining, developing, and managing a hydrocarbon-producing portfolio are distributed among various individuals in an organization. These individuals can be segregated based on job function, into functional groups, or based on the assets being developed, into asset development teams. Each asset development team typically comprises an individual from each of the functional groups required to define, develop, and manage the asset of concern in the portfolio. Thus, the terms asset team members or functional groups may be loosely and interchangeably used to refer to individual users in the organization which generate portfolio relevant data, typically as part of their assigned job function.

As illustrated in Figure 10, in this example, the functional groups in the organization which generate portfolio relevant data include Geoscientists 70, such as Geologists or Geophysicists, Landmen 72, Reservoir Engineers 74, Regulatory Compliance Administrators 76, Drilling Engineers 78, Right-of-Way Administrators 80, Completion Engineers 82, Finance Analysts 84, Field Operators 86, Sales and Marketing Representatives 88, and Managers 90. The functional groups may also include Production Engineers, Facility Engineers, Material and Logistics Specialists, and other professionals, not shown in Figure 10. In this example, these functional groups, for the most part, are the users of the information management system. However, it should be understood that the invention is not limited to these users.

In the process of developing and/or managing assets (wells/properties) in a hydrocarbon-producing portfolio, typically each of the functional groups is

required to generate particular data relevant to their function and related to the function of other groups. This related data must be communicated to the other function groups on the asset team (or the other asset team members) whose functions are dependent upon such data. Since the functions of members on an asset development team for a hydrocarbon-producing portfolio are, generally, standard industry wide, a variety of software applications have been developed for, and are typically used by, each of the respective functional groups to assist in the collection, generation, and/or analysis of data particular to their respective function. Because these software applications, for the most part, are function specific, they do not facilitate global sharing and communication of data between the various groups which make up the asset development team. Examples of commercially available software applications for each functional group and the type of data generated by each group are provided below.

Examples of an application which may be used by a Geoscientist **70** to generate and store geoscience related data are applications sold under the trademark "Open Journal" and "Open Works" by Landmark Graphics Corporation of Houston, Texas. Data generated by a Geoscientist **70** may include, for example, screenshots of 3-D seismic surveys, well log types and curves, and other well characterization data such as the net effective pay, porosity, and water saturation (fractional volume of reservoir pore space filled with water) of the reservoir penetrated by various wellbores, and coordinates of prospective wells.

One example of an application which may be used by a Landman **72** to organize and store land related data is a petroleum land management application, such as the one sold under the trademark IWS LAND by IHS Engineering of Englewood, Colorado. Data generated by a Landman **72** may include, for

example, a lease initiation date, lease expiration date, royalty, gross or working interest, net revenue interest, and lease obligations for a given well or surface property.

Examples of applications which may be used by a Reservoir Engineer 74 to  
5 generate and store data include applications sold under the trademarks PEEP  
DECLINE and WELL LOG by Merak Projects, Inc, of Houston, Texas. Data  
generated by a Reservoir Engineer 74 may include, for example, reservoir  
historical data such as production versus time data for a given well, or wells in  
similar formations or for other wells in the same formation.

10 One example of an application which may be used by a Regulatory  
Compliance Administrator 76 to store relevant data is a spreadsheet application,  
such as one sold under the trademark MICROSOFT EXCEL by Microsoft  
Corporation of Redmond, Washington. Data of relevance to a Regulatory  
Compliance Administrator 76 may include, for example, field names, regulatory  
15 field names, and zones penetrated by a given well. Regulatory data may also  
include any information related to which well is to be completed, what zone or  
reservoir was completed, well test results, and other data required for submission,  
typically on special forms, to government agencies charged with regulating  
petroleum production. Examples of such forms include "G-1" and "G-10" forms  
20 required by the Railroad Commission of Texas. Currently electronic filing  
systems are being set up by various regulatory commissions, such as the Railroad  
Commission of Texas, so that these forms can be accessed, filled out, and  
submitted over the Internet.

Examples of applications which may be used by a Drilling Engineer 78 to  
25 generate and store data related to drilling include applications sold under the



trademarks DIMS by Landmark and WELL LOG by Merak. Data generated by a Drilling Engineer **78** may include, for example, data related to drilling and well specifications (e.g., bit and casing size, depth, etc.) and data related to equipment required to build a drilling location and drill the well (e.g., pipe sizes, pipe lengths,  
5 pipe quantities; types and quantities of cement, gravel, and boards; contract services, capital equipment). Data generated by the Drilling Engineer **78** may also include cost tracking information, and rig scheduling (time and place allocation of capital equipment).

Examples of applications which may be used by a Finance Analyst **84** to  
10 generate and store data include applications sold under the trademarks PEEP by Merak, and ARIES by Landmark. Data generated by a Finance Analyst **84** may include, for example, any economics data, such as the working interest payable on a property or the royalty obligations owed to a lessor on a particular property, and any partner operations data. To calculate this economic data requires data related  
15 to well production on selected properties, lease terms, etc.

Examples of applications that may be used by a Field Operator **86** to generate and store relevant data include applications sold under the trademarks DIMS by Landmark and WELL VIEW by Merak. Additionally, relevant field operation data, such as production and pressure data, may be captured in real time  
20 using a measurement and control system, such as a SCADA system (supervisory control and data acquisition system) which captures production data in real time. Data generated or provided by a Field Operator **86** may include, for example, production levels, tank levels, well pressures, flow rates, perforation dates, etc. Once generated, this production information may be provided to Geoscientist and  
25 Reservoir Engineer applications for updating geological and production prediction

models so that future predictions will be based on the most current information available. Also, perforation dates may be provided to Landmen, for example, for comparison with lease dates and terms.

Applications which may be used by Sales and Marketing Representatives  
5 88 to generate data include production forecast applications such as forecasting software sold by Merak and Schlumberger Geoquest. Data generated by Sales and Marketing Representatives 88 include, for example, production forecast data used to determine future market value and sales volumes for marketing and selling expected hydrocarbons. To provide accurate forecasts, Sales and Marketing  
10 Representatives require up to date information related to production of currently producing wells, expected production from wells currently being drilled and expected to be drilled.

Examples of applications which may be used by a Portfolio Manager 90  
include one sold under the trademark Merak Capital Planning by Merak. Data  
15 generated by a Portfolio Manager 90 may include, for example, optimized resource allocation schedules and reports, portfolio inventory reports and figures, and economic forecast summaries. Generation of accurate data by a Portfolio Manager 90 requires update information on essentially every facet of the portfolio assets being considered, thus data from each of the functional groups on the asset  
20 teams.

To streamline the management of information for the hydrocarbon-producing portfolio, data generated by each of the functional groups needs to be captured, organized, and communicated between the functional groups involved in the defining, development, and management of the portfolio. Referring to Figure  
25 11, in this example, capturing, organizing, and communicating data between the

functional groups is facilitated by serving applications **108** to respective users **106** and storing related data generated by the respective users **106** in a commonly accessible data repository **102**.

5 The applications **108** may comprise separate or distinct applications directed to separate functional groups for generating or entering data relevant to the function of that functional group, such as the function specific applications described above. Referring to Figure 11A, alternatively the applications **108** may comprise a plurality of application modules **108a** embedded in one or more parent applications (such as **104**), wherein each module **108a** is direct to one or more  
10 particular functional groups for generating or entering data relevant to the portfolio.

The data generated by each application **108** is, preferably, stored in a common or commonly accessible data repository (or data warehouse) **102** which may comprise a single database or a plurality of databases on a common server  
15 **110** or accessible through a system network. When any of the applications **108** is used to modify related data linked to a key parameter field, data linked to that key parameter field will be updated in the data repository **102**. Additionally, related data residing in databases outside of the data repository and linked to the key parameter field may also be updated. When data having the key parameter field is  
20 updated in the data repository **102**, the updated data is served to any of the other applications **108** when those applications **108** retrieve data from the data repository **102** having the key parameter field.

#### Data Storage Manager

25 In this example, a database management system is developed to capture and

organize data in the data repository **102**, and to communicate data to the various applications **108** in the system. Database management systems, in general, typically comprise a suite of programs which manage large structured data sets. In this example, the database management system controls the organization, storage, and retrieval of data (i.e., fields, records, and files) in the data repository **102** and also includes means for data security and integrity. The database management system also incorporates business process rules **112** to govern the generation and flow of information such that it models the information flow of the organization. Referring to Figure 11, in this example, the database management system including the data repository **102** are collectively referred to as the Data Storage Manager (DSM) **100**.

The DSM **100** comprises an Oracle database **102a** system with an Access front-end **104**. The DSM **100** provides a fully integrated data repository **102** for capturing and organizing data and other information related to the hydrocarbon-producing portfolio. In this example, the system includes a network having one or more servers **110** which connect various users **106** to the DSM **100**. This system allows the DSM **100** to be accessed by a plurality of users **106** in a plurality of different locations. Connection to the DSM **100** may be implemented in any way known in the art, such as via Internet or intranet connections, LANs, WANs, or through similar technology. As a common data repository **102**, substantially all essential information relevant to defining, developing, and managing assets in the hydrocarbon-producing portfolio is stored onto the DSM **100** by the plurality of users **106**, or made accessible to or through DSM **100**.

Those skilled in the art will appreciate that data in the data repository **102** is structured or organized in terms of fields (individual items of information), records

(a complete set of related fields), and files (sets of records). For example, a record in the data repository **102** may comprise all data in the repository **102** related to an individual asset (well or prospective property) in the portfolio. Those skilled in the art will also appreciate that data in the data repository **102** relating to a particular asset can be linked or tied to a key parameter field and various fields and/or records may be tagged for use by the various applications based on the key parameter field. For example, unique American Petroleum Institute (API) well codes (assigned to all wells in the U.S.) may be used as the key parameter field for each record to link related data generated by different applications **108** or stored in other related systems. In the case of prospect wells or properties that have not been assigned an API well code, a unique project identification number or code can be assigned and used as the key parameter field used to tag or link data related to a particular prospect. Once an API well code is assigned, these project identification codes can be linked to or replaced by the assigned API well code if desired.

In this example, each record for a given asset in DSM **100** may comprise thousands of fields of data; thus the fields associated with each record will not be listed here. However, in general, for a hydrocarbon-producing portfolio, the DSM **100** will typically include specific data components, such as Land **100a**, Regulatory **100b**, Geology **100c**, Reservoir **100d**, Facilities **100e**, Rig Scheduling **100f**, Financial **100g**, and Automatic Notification **100f**, as illustrated for example in Figure 16. Although the specific fields provided for each data record are not presented here, those skilled in the art will appreciate that such data fields can be determined through assessment and analysis of the business structure, information generation, and information flow for a particular organization of interest.

Referring to Figure 11A, business process rules **112** are embedded in the DSM **100**. In some cases, application of particular business process rules **112** may dictate that data in certain data components cannot be entered until data in one or more preceding data components has been provided. For example, referring to  
5 Figure 16, Rig Scheduling data **100f** for a given well may not be entered until Geology **100c** and Reservoir **100d** data, such as the x-y coordinates for the well location and expected well characteristics, have been entered and the well has been approved for drilling. Also, in some cases, data input in one component may result in an action (such as an automatic notification **100h**) or automatic  
10 generation of data in another component. For example, input of equipment cost tables and a drilling equipment list for a particular well design may result in the automatic calculation of the estimated drilling cost data. Advantageously, such automatic calculations can be embedded in the system to insure uniformity between calculation methods used throughout the organization.

As illustrated in Figure 11A, in this example, the DSM **100** comprises a front-end user interface **104** segregated into a plurality of application modules **108A** directed to specific users. This front-end interface **104** allows particular  
15 users **106** to use applications they would normally use to analyze asset characteristics and generate data and then transfer or enter their resulting relevant data directly into their respective DSM application module **108A**. Examples of  
20 general types of relevant data that may be provided to DSM **100** by the various users **106** are shown, for example, in Figure 12. This data includes geology/geophysics data **70a**, reservoir data **74a**, regulatory data **76a**, land data **72a**, completion data **82a**, rig schedule data **77a**, drilling data **78a**, finance data  
25 **84a**, lease data **85a**, and right-of-way data **80a**.

Referring back to Figure 11, the DSM **100** is also designed so that work product generated by users **106** and relied upon to obtain relevant data, such as graphics, analysis notes, spreadsheets, can be captured in DSM **100** and stored as related data in the data repository **102** for review or reference by other users **106**.

5 For example, if a Geologist relies on seismic curves or other data generated using Open Works or Open Journal to obtain a well location, the Geologist can capture an image of the file, and then through DSM **100** access and view the captured file and, if desired, store the file using DSM **100** in the data repository **102**. This capability allows DSM **100** not only to capture basic portfolio data, but also to  
10 capture work product illustrating the reasoning process behind how the data were obtained.

Examples of key links between DSM **100** and other software applications or systems outside of the DSM **100** system in this example which permit users **106** to either view, capture, or links to common data generated by the applications and  
15 systems are illustrated in Figure 13. For example, DSM **100** can link to or be linked from field related information systems **120**, such as an application sold under the trademark Well View by Merak **121** which is used to capture well design and operation information, an application sold under the trademark DIMS by Landmark Graphics, Corp. **122** which is used to capture drilling and well  
20 services information, and a field data capture (FDC) system **123** which is used to capture production data. DSM **100** also can link to geoscience applications **124**, such as to the previously mentioned applications sold under the trademarks Open Journal **125** and Open Works **126** by Landmark Graphics, Corp which are used to generate geoscience documents and workstation data. DSM **100** also can link to  
25 or be linked from spatial data applications **127**, such as the desktop mapping and

geographic information system (GIS) sold under the trademark ArcView **128** by Environmental Systems Research Institute (ESRI) of Redlands, California. Arc View **128**, for example, can be used to map and analyze spatial and relational data stored in DSM **100**, such as well locations.

5           DSM **100** also can link to or be linked from operations systems **133**, such as to and from facilities **134**, pipelines **135**, and marketing and sales **136**. DSM **100** also can link to or be linked from accounting systems **129**, such as the revenue accounting system sold under the trademark IBP **130**, the cost accounting system sold under the trademark SAP **131** by SAP of Walldorf, Germany, and the land  
10          accounting system sold under the trademark IBS **132**. Additionally, DSM also can link to or be linked from financial and planning analysis systems **137**, such as planning tools **138**, economics applications such as the one sold under the trademark PEEP by Merak **139**, and optimization applications **141**, such as ones sold by Merak, Schlumberger Geoquest, and Landmark Graphics.

15           Referring to Figure 11A, data security **113** and integrity **114** for DSM **100** are maintained through read/write privileges which are embedded in the system to prevent unauthorized users from viewing or altering data in the data repository **102**. For example, user profile information (username, password, function/title, etc.) is required to access data in the data repository **102**, and write privileges are  
20          granted by function. For example, only a user **106** classified as a Supervisor may enter data indicating that a project has been approved, and only a user **106** classified as a Drilling Engineer may alter any well design data. These restrictions are only an example of business processes rules **112** of an organization which can be embedded into DSM **100**.

25           The integrity **114** of the data in DSM **100** is maintained by only allowing



one user **106** to update data at the same time. For example, if a user **106** wishes to modify information in a particular record, the user may “capture” that record or an aspect of that record, for example, by clicking on an “edit” button in the user’s DSM application **108**. Once the data is captured, the user **106** may make changes  
5 to the record as governed by the embedded business process rules **112**. The user can then store the updated data in the data repository **102** of DSM **100**, for example, by clicking on a “save” button in the application **108**.

Additionally, the DSM **100** prevents users **106** from storing duplicate records in the data repository **102**. For example, the DSM **100** will not store a new  
10 well record having the same API number (unique key parameter field) as a current well record in the data repository **102**. Additionally data integrity **114** may be insured by applying standardized business formulas to automatically calculate data values based on values for related data. For example, an estimated drilling cost for each project may be automatically calculated based on a list of drilling equipment  
15 needed, a standardized equipment costs list (maintained by cost analysts), and a standardized miscellaneous cost factor of +5% of calculated costs to obtain the estimated drilling costs.

As previously noted, serving the DSM **100** through an applications server connected to a network allows the DSM **100** to be dynamically updated and  
20 accessible to a plurality of users **106** in various locations. For example, local computers may access DSM **100** through intranet or LAN systems. Remote computers, such as those in the field or other remote offices, may dial-in to the DSM **100** using modems or similar remote access technology or connect via WANs to update and view information. Alternatively, access to DSM **100** may be  
25 provided through the Internet, wherein a web server operatively couples to the

**DSM 100.**

Providing an information and knowledge management system that permits asset team members to readily access portfolio relevant data generated by other members may result in increased accountability between members of the asset team. For example, with this type of system it becomes readily apparent who may be holding up progress in the development of a particular asset by not providing timely or accurate data to the system. With this type of system, supervisors or managers can access the data repository to determine which subordinates have not timely completed functions or entered their corresponding data.

Further, storing portfolio relevant data generated by the individuals responsible for such data as part of their work routine in DSM 100, provides an element of data integrity and an increased efficiency in the development and management of the portfolio. Additionally, this type of information and knowledge management system provides the ability to model various portfolio scenarios (to be further described) without the difficulty of data collection, since substantially all of the relevant data is stored or readily accessible through a system such as DSM 100.

*Use of DSM by Functional Groups*

An example of how the DSM 100 may be used by the various members of an asset team will now be discussed.

Referring to Figure 10, to initiate development of a property a Geoscientist is first relied upon to predict whether or not oil/gas accumulations exist in the field. To perform this function, screen shots of seismic curves, log types and curves, well characteristics, etc. may be generated and interpreted by the

Geoscientist **70** in his determination of where hydrocarbons are likely to exist in the given area. Based on his interpreted data, the Geoscientists **70** determines x,y coordinates for well drilling locations where he believes the best chance for finding oil/gas will be. Once the Geoscientist **70** determines the x,y (map) coordinates for prospective drilling locations this information is stored in the data repository and can be accessed by other functional groups who require this information. Additionally, once the Geoscientist **70** has provided the map coordinates to the data repository by generating a location in his application, automatic notifications can be sent to specified functional groups who have need of the map locations, such as Landmen **72**, who would check lease obligations and status against the proposed locations.

Once map coordinates are provided to the system, for example, the data commonly used by a Reservoir Engineer's **74** application (such as map locations) are automatically updated to reflect the location for a new drilling prospect. This allows the Reservoir Engineer **74** to immediately check the locations against reservoir maps and begin his assessment of what is likely to result in terms of production based on prospect location information provided by the Geoscientist **70**. Similarly, data used by the Landman's **72** application is automatically updated with the new location which allows the Landman **72** to immediately check the location against lease obligations and begin any necessary lease activity required to clear the location for drilling. The data used by the Drilling Engineer's **78** application is also automatically updated, which permits the Drilling Engineer **78** to immediately check the prospective location against current rig locations, locations of site building equipment and, if necessary, generate new rig schedules based on the updated information. The data used by the Finance Analyst's **84**

application is also automatically updated to reflect the new data provided by the Reservoir Engineer **74** and Drilling Engineer **78**, which permits the Finance Analyst **84** to apply business process models, such as to plot well schedules into a production forecasting tool such as "ProCast"(described below) and generate cash  
5 flow forecasts based on the newly updated prospect information. The data used by the Sales and Marketing Representatives' **88** application may also be automatically updated based on the most recently generated production forecast, which permits the Sales and Marketing Representatives **88** to immediately account for the change in the portfolio data in plots of ProCast against product price  
10 forecasts.

Based on the x,y coordinates and analysis of related information (e.g., production vs. time for similar formations, or wells drilled in same formation) the Reservoir Engineer's **74** function is to predict production resulting from drilling a well at the coordinates provided by the Geoscientist **70**. Data related to the  
15 Reservoir Engineer's **74** prediction is then updated in the data tagged to the Reservoir Engineer's **74** application, and the updated data may then be used to automatically update corresponding data in other applications, such as the Finance Analyst's **84** application. Additionally, the system may be programmed to provide an automatic notification to other functional groups that the updated reservoir data  
20 are now available. For example, predicted production data may be automatically "tagged" to the Drilling Engineer's **78** application to permit Drilling Engineer to begin work on designing drilling specifications for drilling at the particular location to obtain the predicted production. This predicted production data may also be tagged to be used by a management application to allow a Manager **90** to  
25 determine whether or not current or future resources should be allocated to drill

the particular location, or whether or not a particular property (undeveloped leases and/or producing wells) should be held in the portfolio or sold. The predicted production may also be used to automatically update the Finance Analyst's **84** application so that the expected new production can be taken into account in  
5 economic forecasts performed by the Finance Analyst **84**.

Using data provided by the Geoscientist's **70** application to the Landman's **72** application, the Landman **72** is able to immediately begin work on securing lease agreements if necessary for drilling, or can evaluate current lease agreements which are already in place. Once a lease on the desired property is secured, the  
10 Landman **72** may input and store pertinent lease information, such as primary lease dates, secondary lease dates, and lease obligations. Other aspects of the Landman's **72** application may affect data relating to the prospect locations. For example, if a particular location is outside of a permissible position on a particular lease, the Landman's **72** application can adjust the location to comport with lease  
15 requirements, surface hazards, and/or regulatory requirements. The Geoscientist **70** and Reservoir Engineer **74** can be automatically notified of the proposed change in the location and can either accept the new location or indicate that the prospect should not be drilled as altered by the Landman **72**.

Drilling Engineers **78** may use cost of materials data and well construction  
20 cost data provided by Field Operators **86** and materials management personnel in the organization to generate accurate cost estimates for drilling particular prospective well locations. These estimated cost data can also be used by the Financial Analysts **84** to generate financial performance predictions based thereon. As drilling cost estimates change based on real drilling cost experience, reported  
25 changes in materials costs, or changes in the costs of building locations, for

example, the cost data when so updated by the Drilling Engineer 78 in designing wellbores can also be used by the financial analysts to update financial performance of the prospective locations in the portfolio.

Regulatory Administrators 76 may access data such as the locations and target reservoirs of proposed wells to populate drilling permit applications for filing with the appropriate government agencies. Similarly, production test data generated by the Reservoir Engineer 74 may be tagged for use by the Regulatory Administrators 76 for populating well production test forms to be reported to the appropriate government agencies.

The above description is only an example of how a DSM 100 may be used as part of a data management system to collect and communicate portfolio relevant data, generate business process modeled data, and to model information process flow for a hydrocarbon-producing portfolio. A similar information management system may be developed for managing other types of information based on an analysis of an organization's business and information process flow and associated business process rules. In view of the above description, other embodiments of the invention will be apparent to those skilled in the art.

#### Production Forecast Application

Referring to Figure 14, another aspect of the system for managing information for a hydrocarbon-producing portfolio is a portfolio production forecasting tool which seamlessly links to a dynamically updated data repository. In one embodiment, the production forecasting tool comprises a production forecast application, referred to as "ProCast". ProCast generates gas/oil production forecasts for specified time periods, such as one month, two months,

and for the next 24 months, including any predicted production decline.

As illustrated in Figure 14, ProCast **140** links to the data repository of DSM **100** to obtain current drilling schedules **144**, obligations schedules **146**, portfolio inventory **148**, and the characteristics of wells to be drilled **150**. For example, ProCast **140** may obtain as inputs from DSM for each well its initial production, decline coefficients and rate level for each pressure stages, probability of success, number of days to drill, number of days to put on production, and start of drilling data. It can then utilize this data to calculate on a daily basis the expected production of each well. Since DSM **100** is continually updated with new information generated by various users in the system, such as Geoscientists, Reservoir Engineers, Landmen, production forecasts are assured to be based on up-to-date, substantially real-time information.

ProCast **140** may also be adapted to link to a production database (PDB) **152** to obtain current and historical production information on currently operating wells. Data in the PDB **152** is also continuously updated and, thus, also provides the most accurate up-to-date, substantially real-time view of production. By providing a forecasting tool such as ProCast **140** and seamlessly linking it to a continuously updated data repository, such as the DSM **100** and the PDB **152**, creation of a forecast based on accurate and substantially real-time data can be assured.

Those skilled in the art will appreciate that ProCast **140** retrieves and links data from DSM **100** and PDB **152** based on key parameter fields. For example, each well is assigned a unique code which serves as a key parameter, and ProCast **140** accesses well records based on this key parameter field and extract data required from each record to forecast the corresponding production for that well.

Additionally, ProCast **140** can be used to forecast production resulting from various proposed drilling schedules provided to ProCast **140** as input. As a result, ProCast **140** can be used to satisfy an organizations requirement of delivering forecast gas/oil volumes that relate to various proposed scenarios generated using  
5 a resource allocation optimization tool as further discussed below.

It should be understood that some functionality similar to that provided by ProCast **140** as described above is also available in commercial software applications sold by Merak, Schlumberger Geoquest, and Landmark Graphics. Thus, such applications could alternatively be used as the production forecasting  
10 tool of choice to link to a dynamically updated data repository, such as the DSM **100** system described above.

#### Portfolio Optimization Application

Referring to Figures 15-17, another aspect of the system is a portfolio  
15 optimization tool which seamlessly links to a dynamically updated data repository. In one embodiment, the portfolio optimization tool comprises a portfolio optimization application, referred to as the “Optimizer” **160**. The Optimizer **160** system in this example allows for the development of an operations-ready drilling schedule that can be optimized with respect to a selected financial performance or  
20 production performance criterion. The Optimizer **160** is built to seamlessly link to DSM **100**, hence to the portfolio inventory and obligations schedule.

Referring to Figure 15, one of the main functions of the Optimizer **160** is to optimize asset development opportunities based on the selected criteria **164** to achieve a given goal, target, or a set of goals. Selected criteria **164** used in  
25 Optimizer **160** to determine optimized drilling schedules **172a**, for example,



include: 1) drilling the most profitable or highest value wells first; 2) drilling the quickest pay-out wells or cheapest wells first; 3) achieving a set of net cash flows per year for the next 15 years; 4) achieving a set of earnings and a set of gas production volumes; 5) optimizing the drilling schedule given a set amount of capital dollars per year; and/or 6) drilling a certain number of wells per year. From a selected criterion, the Optimizer 160 may be used to generate a drilling schedule 172a, a corresponding gas/oil production forecast 172b (when used in conjunction with ProCast 140), and a series of net cash flows and capital expenditure dollars 172c by year and by field.

As illustrated in Figure 15, the Optimizer 160 mimics business flow by taking into consideration business targets 162, optimization criterion 164, gas/oil prices 166, portfolio inventory 168, and obligation schedules 170 to determine an optimized allocation of resources 172. As illustrated in Figure 16, the Optimizer 160 links to the DSM (100 in Figure 16) and creates a drilling schedule 172a by utilizing data already captured in the data repository of DSM 100, such as the obligations schedule 170, portfolio inventory 168, and characteristics of wells to be drilled 169. Since the DSM 100 is continually updated with new information generated by various users in the system, such as Geoscientists, Reservoir Engineers and Landmen, creation of a current optimum drilling schedule 172a can always be assured.

Additionally, through the Optimizer 160, various development scenarios can be produced with different capital requirements, cash and earning profiles, and volume results over various time frames. As illustrated in Figure 16, Optimizer 160 is able to then link to ProCast 140 to generate production forecasts corresponding to the various scenarios. This is done by using an optimized

drilling schedule (**172a** in Figure 17) generated using Optimizer **160** and providing it as the drilling schedule **172a** entered into ProCast **140**.

As illustrated in Figure 17, the Optimizer **160** may also be used to process the portfolio **174** such as by ranking the various oil and gas fields that form the  
5 business based on selected criterion **164**, to determine which assets to sell **175**, acquire **176**, hold **177**, or further develop **178**. In this way, the Optimizer **160** is able to provide several benefits to the decision making process of a business unit as well as streamline, organize, and implement clearly defined business rules into the portfolio management process.

10 Referring to Figures 16 and 17, an optimization application, such as the Optimizer **160**, combined with the DSM **100** system can be used to streamline an organization's ability to make daily decisions and implement the work program **178**. It can also be used to ensure project development is being optimally implemented, and to develop the capability to capture the work program **178** and  
15 expected production and monetary results in a nearly real-time manner.

It should be understood that functionality similar to that of the Optimizer **160** is also available in commercial software applications, such as those sold by Merak, Schlumberger Geoquest, and Landmark Graphics. Thus, such applications may alternatively be used as the optimization tool of choice to link to a  
20 dynamically updated data repository, such as the DSM **100** system described above.

An information management system comprising components such as the DSM **100**, Optimizer **160**, and ProCast **140** can be used to manage information for any type of assets or groups of assets to give the business unit the capability to  
25 better manage and allocate resources for a large portfolio having various

components defined and developed by a plurality of different individuals. In the case of a hydrocarbon-producing portfolio, optimization of the portfolio and forecasting of production are greatly enhanced by developing a system which results in the collection of data required for both these systems as part of a daily work routine. This type of system provides an efficient method for obtaining data in near real-time which reflects the most current portfolio of prospects, interpretations of reservoir characteristics, and estimated costs of drilling and completing wells in the prospect inventory.

By developing a database management system which accepts related data from all function groups and an optimization tool which seamlessly connects to the data repository system, data availability, which was an arduous task in the prior art, is now close to a non-event, being effectively built into the normal daily work process. As a result, the effective management of the portfolio is streamlined and the organization no longer has to slow down for the collection of portfolio data, since an inventory of future prospects and their expected performance characteristics are continuously stored and updated in the data repository system. Additionally, using this information management system, the impact of changing optimization criteria can be quickly evaluated, and “what-if” scenarios can be generated quickly. Further, the financial performance and production volumetric impacts of using more or fewer drilling rigs can be quickly seen, and how many wells need to be drilled to achieve a certain net-cash low requirement, and what is needed to reach a certain gas-production plateau can all be quickly determined.

Advantageously, embodiments of the invention may provide an integrated process and software system able to drive and facilitate the efficient, effective, and

live transfer of information, data, and knowledge among and between multiple business team members of an organization both within the office and remotely located in field operation environments. Embodiments of the invention may also be used to provide a more consistent application of various business rules and principles among the multiple business team members throughout the organization. Additionally, embodiments of the invention may provide consistency in data and information formatting throughout an organization by providing a uniform data platform that can be used throughout the organization or, alternatively, by providing a system which involves the usage of various data platforms by multiple business team members and communication of data between the platforms. Embodiments of the invention may also provide the ability to historically track changes in information, data, and knowledge used in analyzing past results to determine new changes necessary in the decision making processes to improve future business results. These are only examples of advantages that may be provided by specific embodiments. It should be understood that the invention is not limited to any particular advantages.

While the invention has been described with respect to exemplary embodiments, those skilled in the art will appreciate that other embodiments may be devised which do not depart from the spirit of the invention. Accordingly, the scope of the invention should be limited only by the following claims.

## CLAIMS

What is claimed is:

- 1 1. An information management system, comprising:  
2 a data repository adapted to store related data tied to a key parameter field;  
3 and  
4 at least one application server adapted to provide a plurality of applications  
5 to a plurality of users, the at least one application server operatively coupled to the  
6 data repository, each of the applications adapted to generate at least some data  
7 having the key parameter field, the at least one application server adapted to  
8 retrieve and update selected ones of the related data when ones of the applications  
9 use and generate application data having the key parameter field.
- 1 2. The system as defined in claim 1, wherein the data repository is adapted to  
2 store all data generated by each of the applications.
- 1 3. The system as defined in claim 1 wherein the data repository comprises a  
2 plurality of databases each adapted to store data from a respective one of the  
3 plurality of applications.
- 1 4. The system as defined in claim 1, wherein the related data are relevant to a  
2 hydrocarbon-producing portfolio, and the plurality of applications comprises at  
3 least two selected from the group of a geoscience application, a petroleum land  
4 management application, a drilling engineering application, a finance application,  
5 a reservoir engineering application, a sales and marketing application, and a field  
6 operations application.

1 5. The system as defined in claim 1, wherein the plurality of applications  
2 comprises at least one selected from the group of a database management  
3 application, a portfolio management application, and a portfolio forecast  
4 application.

1 6. The system as defined in claim 5, wherein the related data are relevant to a  
2 hydrocarbon-producing portfolio and the database management application  
3 comprises a front-end user interface operatively coupled to the data repository and  
4 adapted to generate at least some data having the key parameter field when ones of  
5 the plurality of users enter data into the front-end user interface.

1 7. The system as defined in claim 6, wherein the front-end user interface  
2 comprises a plurality of different application modules each directed to specific  
3 ones of the plurality of users.

1 8. The system as defined in claim 5, wherein the portfolio management  
2 application comprises a resources optimization program adapted to use the related  
3 data retrieved from the data repository to generate an optimized allocation of  
4 resources based on at least one selected criterion.

1 9. The system as defined in claim 8, wherein the selected criterion comprises  
2 at least one selected from the group of developing most profitable assets first,  
3 achieving a selected net cash flow, achieving a selected earnings, achieving a  
4 selected level of production, satisfying obligations on time, and developing assets

5 to achieve the greatest net cash flow in a selected amount of time for a selected  
6 amount of capital.

1 10. The system as defined in claim 8, wherein the applications server is adapted  
2 to automatically update selected ones of the related data when the resource  
3 optimization program generates optimized allocation of resources data.

1 11. The system as defined in claim 5, wherein the portfolio forecast application  
2 is adapted to forecast future performance of assets based on the related data.

1 12. The system as defined in claim 1, further comprising a notification system  
2 adapted to automatically notify at least one user when related data relevant to the  
3 at least one user has been updated in the data repository.

1 13. The system as defined in claim 1, wherein the plurality of users comprise  
2 members of an asset development team having different functions related to the  
3 development and management of assets in the portfolio, each member responsible  
4 for providing particular related data corresponding thereto.

1 14. The system as defined in claim 13, wherein the members of the asset  
2 development team comprise at least two selected from a geoscientist, a landman, a  
3 reservoir engineer, a regulatory compliance administrator, a drilling engineer, a  
4 finance analyst, a field operator, a sales and marketing representative, and a  
5 portfolio manager.

1 15. A management system for a hydrocarbon-producing portfolio, comprising:  
2 at least one server adapted to serve a plurality of applications to respective  
3 users, each of the applications adapted to generate data corresponding to the  
4 respective user, at least some of the data generated by each application having a  
5 key parameter field therein;  
6 a database management system operatively coupled to the at least one  
7 server and adapted to store at least some of the data generated by each application  
8 and update any of the stored data having the key parameter field when ones of the  
9 applications modify any of the stored data having the key parameter field; the at  
10 least one server adapted to serve the updated data to any other ones of the  
11 applications when the other ones of the applications retrieves the updated data  
12 having the key parameter field; and  
13 at least one business process model application adapted to apply a business  
14 process model to selected ones of the stored data to generate modeled data having  
15 the key parameter field, the at least one business process model application  
16 adapted to automatically update the modeled data when any ones of the selected  
17 ones of the stored data are updated by operation of any of the other applications.

1 16. The system according to claim 15, wherein the business process model  
2 comprises creating an optimized drilling schedule.

1 17. The system according to claim 15, wherein the business process model  
2 comprises forecasting hydrocarbon production for a selected drilling schedule.



1 18. The system according to claim 15, wherein the plurality of respective users  
2 comprises at least two selected from geoscientists, landmen, reservoir engineers,  
3 regulatory compliance administrators, drilling engineers, finance analysts, field  
4 operators, sales and marketing representatives, and portfolio managers.

1 19. The system according to claim 15, wherein the plurality of applications  
2 comprises a part of the database management system.

1 20. The system according to claim 19, wherein the plurality of applications  
2 comprises application modules embedded in the database management system.

1 21. A method for managing information, comprising:  
2 serving a plurality of applications to respective users, each of the  
3 applications generating data corresponding thereto, at least some of the data  
4 generated having a key parameter field therein;  
5 storing the data generated by each application;  
6 updating any of the data having the key parameter field when ones of the  
7 applications is used to modify any of the stored data having the key parameter  
8 field; and  
9 serving the updated data to any other ones of the applications when said  
10 other ones of the applications retrieves from storage the data having the key  
11 parameter field.

1 22. The method as defined in claim 21, wherein the plurality of applications  
2 comprises a plurality of separate applications each directed to at least one of the  
3 respective users.

1 23. The method as defined in claim 21, wherein the serving the plurality of  
2 applications comprises serving a parent application comprising a plurality of  
3 application modules, each of the application modules directed to at least one of the  
4 respective users.

1 24. The method as defined in claim 21, wherein the plurality of applications  
2 comprises at least one selected from a geoscience application, a petroleum land  
3 management application, a drilling engineering application, a finance application,  
4 and a reservoir engineering application, a production forecast application, and a  
5 portfolio optimization application.

1 25. The method as defined in claim 21, further comprising:  
2 applying at least one business process model to selected ones of the stored  
3 data to generate modeled data; and  
4 automatically updating the modeled data when selected ones of the stored  
5 data are updated by operation of any one of the served applications.

1 26. The system according to claim 25, wherein applying the business process  
2 model comprises creating an optimized drilling schedule based on a selected  
3 criterion.

1 27. The system according to claim 25, wherein applying the business process  
2 model comprises forecasting hydrocarbon production for a selected drilling  
3 schedule.

1 28. A method for managing a hydrocarbon-producing portfolio, comprising:  
2 having a plurality of asset team members each using an application related  
3 to the function of the respective asset team member to generate data relevant  
4 thereto; the asset team members comprising at least two selected from a  
5 geoscientist, a landman, a reservoir engineer, a regulatory compliance  
6 administrator, a right-of-way administrator, a drilling engineer, a completion  
7 engineer, a finance analyst, a field operator, a sales and marketing representative,  
8 and a portfolio manager; and  
9 automatically updating corresponding data used by any other one of the  
10 applications based on the data generated by using at least one of the applications.

1 29. The method of claim 28, wherein the applications comprise at least two  
2 selected from a seismic interpretation application, a production forecasting  
3 application, a petroleum land management application, a regulatory compliance  
4 application, a drilling engineering application, and a portfolio optimization  
5 application.

1 30. The method of claim 28, further comprising:  
2 applying at least one business process model to select ones of the  
3 corresponding data to generate modeled data.

1 31. The method according to claim 30, wherein the applying at least one  
2 business process model comprises determining an optimized drilling schedule.

1 32. The method according to claim 31, wherein the optimized drilling schedule  
2 is determined based on at least one selected from product price forecasts and  
3 production predictions.

1 33. The method according to claim 32, wherein the optimized drilling schedule  
2 is determined based on a selected criterion comprises at least one selected from  
3 developing most profitable assets first, achieving a selected net cash flow,  
4 achieving a selected earnings, achieving a selected level of production, satisfying  
5 obligations on time, and developing assets to achieve the greatest net cash flow in  
6 a selected amount of time for a selected amount of capital.

1 34. The method according to claim 30, wherein the applying at least one  
2 business process model comprises forecasting hydrocarbon production.

1 35. The method according to claim 30, wherein the applying at least one  
2 business process model comprises automatically populating regulatory forms  
3 based on corresponding data.

1 36. The method according to claim 30, wherein the applying at least one  
2 business process model comprises determining drilling costs associated with at  
3 least one prospectively drilled well.

1 37. The method according to claim 28, wherein the hydrocarbon-producing  
2 portfolio comprises existing and prospective well locations, petroleum land  
3 management information related to the existing and an prospective well locations,  
4 capital equipment disposed in the existing wells, capital equipment proposed for  
5 existing and prospective wells, and estimated hydrocarbon reserves in reservoirs  
6 penetrated by the existing and prospective wells.

1 38. The method according to claim 28, further comprising notifying at least one  
2 of the asset team members that corresponding data used by the one of the  
3 applications used by the at least one asset team member have been updated by  
4 operation of the other one of the applications used by at least one other asset team  
5 member.

1 39. The method according to claim 28, further comprising limiting any one of  
2 the asset team members from updating selected ones of the corresponding data  
3 outside of the function of the any one of the asset team members.

1 40. The method according to claim 28, further comprising restricting selected  
2 ones of the asset team members from updating selected corresponding data prior to  
3 other selected ones of the asset team members generating other selected  
4 corresponding data.

## INFORMATION MANAGEMENT SYSTEM

### ABSTRACT

- The invention provides a system and method for managing related information generated by a plurality of individuals. The information management system includes a data repository adapted to store related data tied to a key parameter field, and at least one application server coupled to the data repository and adapted to provide a plurality of applications to a plurality of users. Each of the applications is adapted to generate at least some data having the key parameter field, and the at least one server is adapted to retrieve and update data when any one of the applications uses and generates data having the key parameter field.
- 10 The method for managing information includes serving a plurality of applications to respective users, wherein the applications are adapted to generate data tied to a key parameter field. The method also includes storing the data generated by each application and updating any of the data having the key parameter field when one of the applications is used to modify any of the stored data having the key
- 15 parameter field. The method also includes serving the updated data to any of the other applications when the application retrieves the data having the key parameter field.

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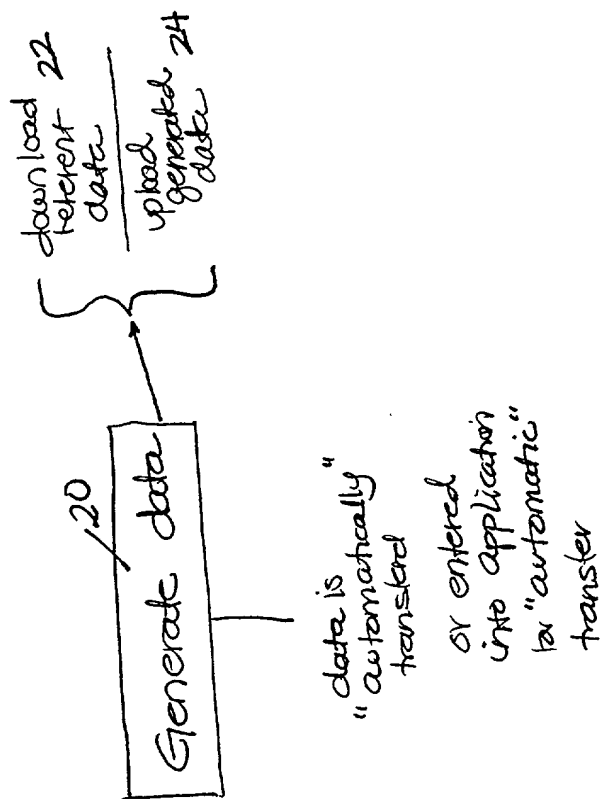


Fig 2



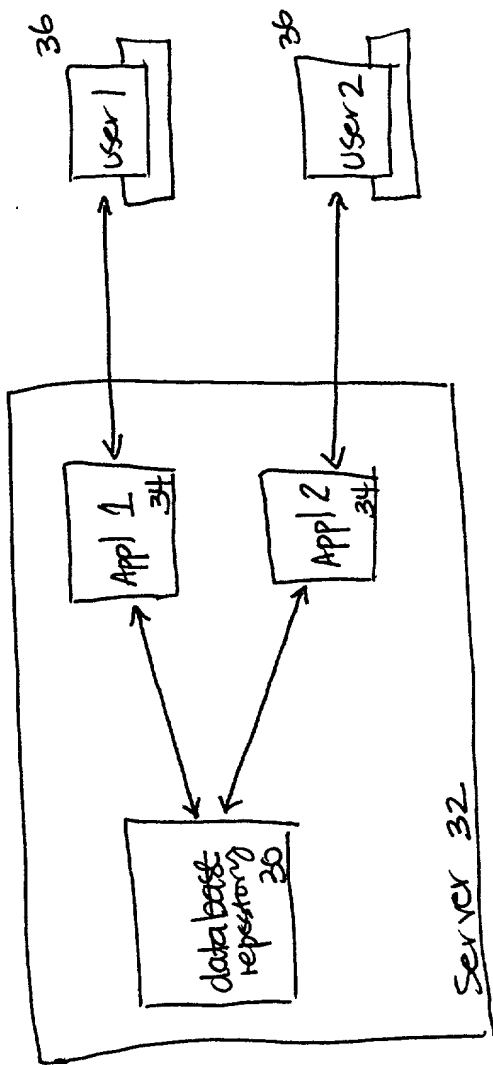


Figure 3

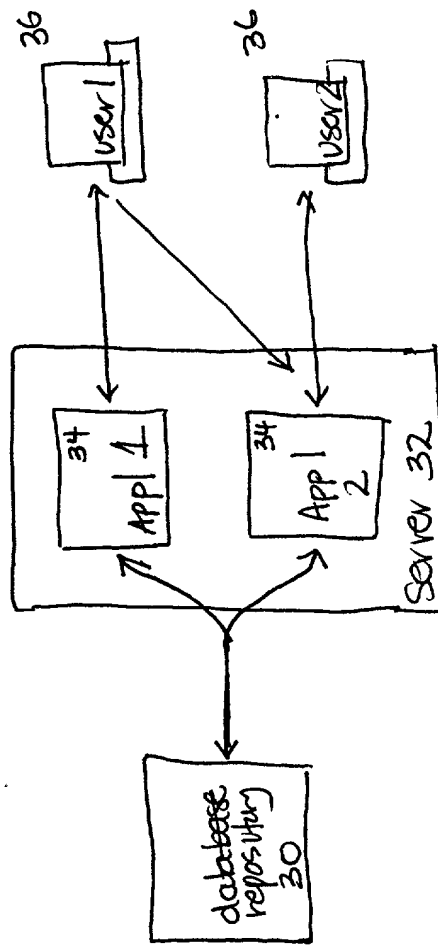


Figure 4

data repository 30

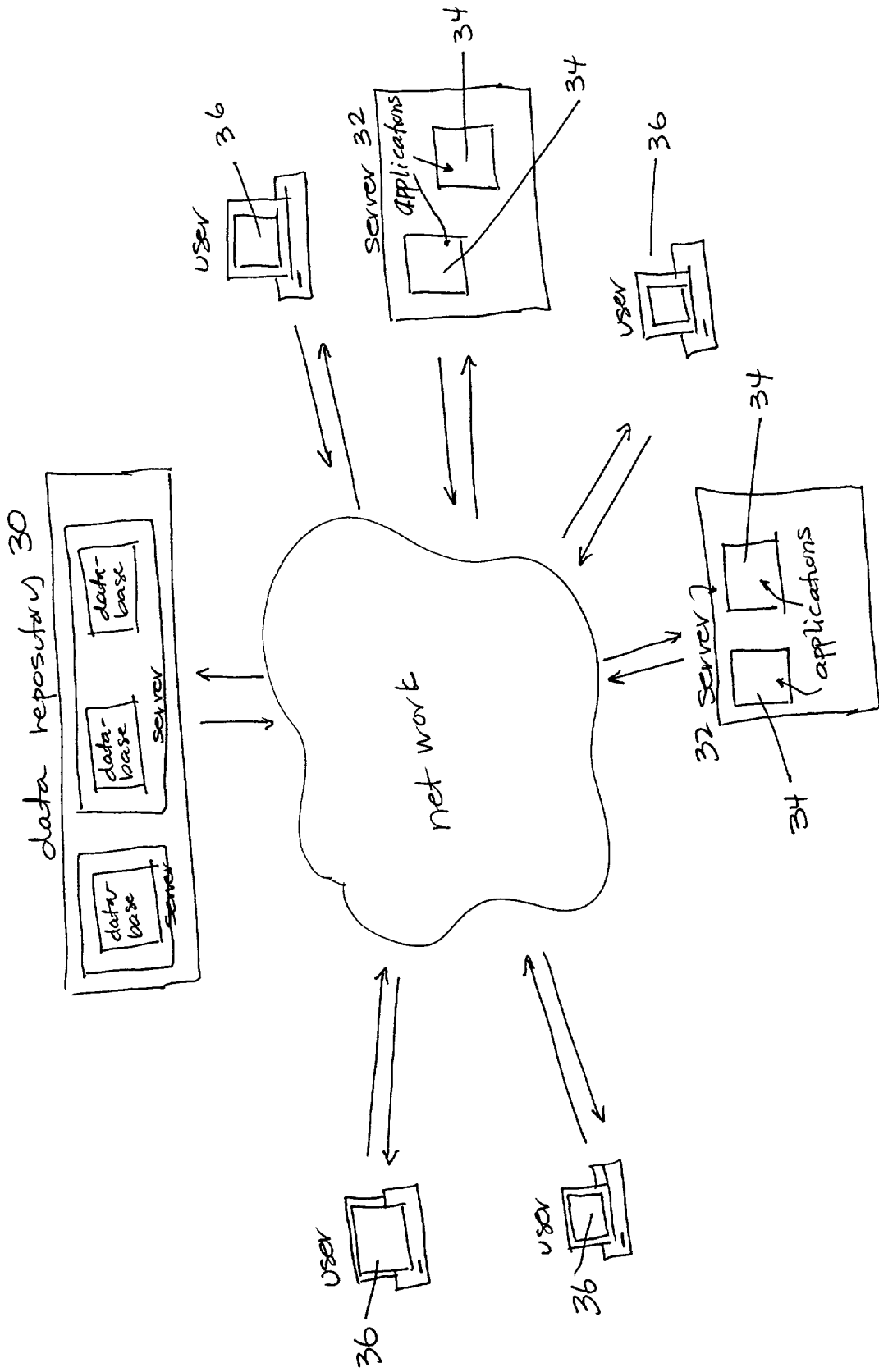


Figure 5

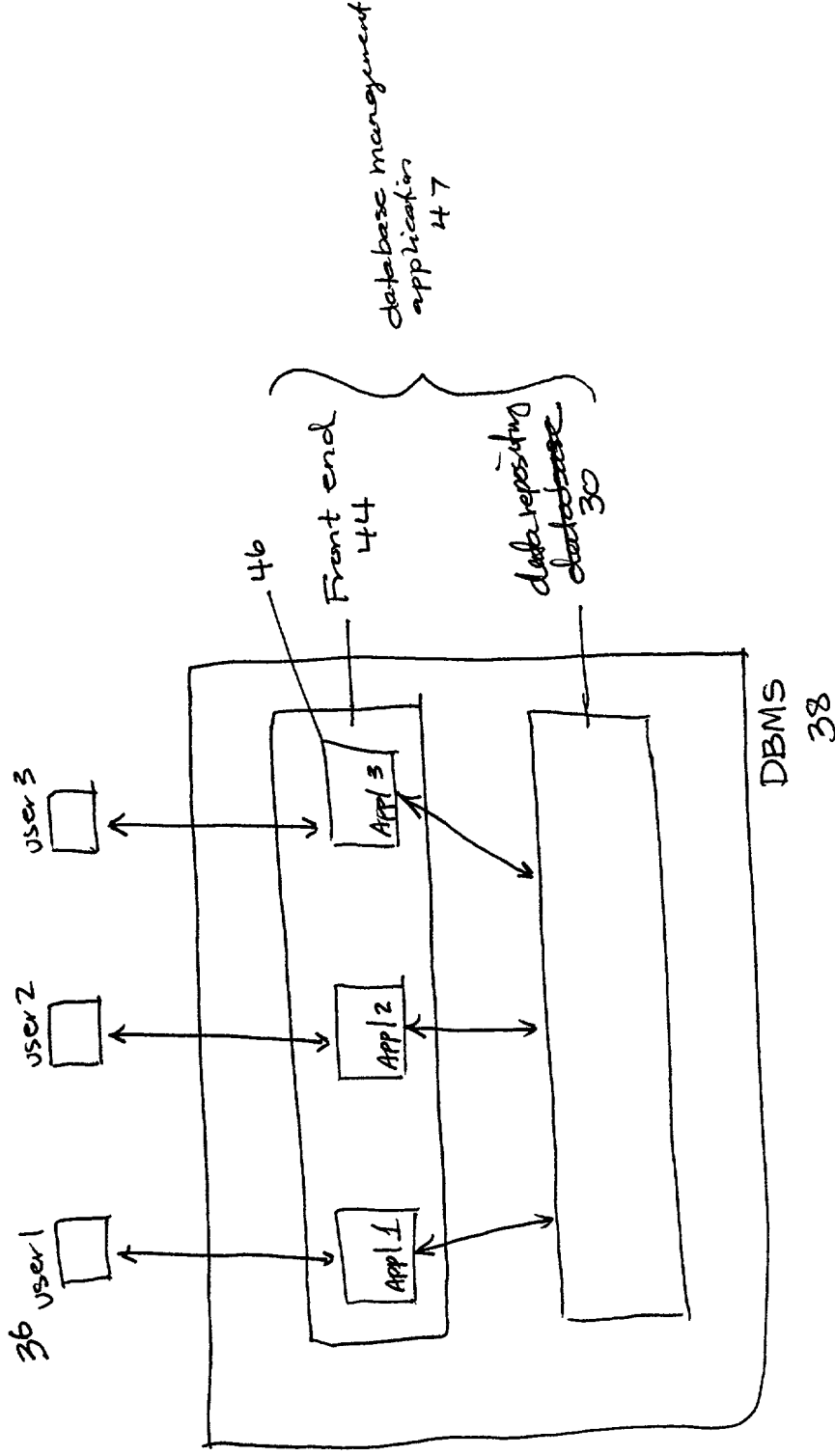


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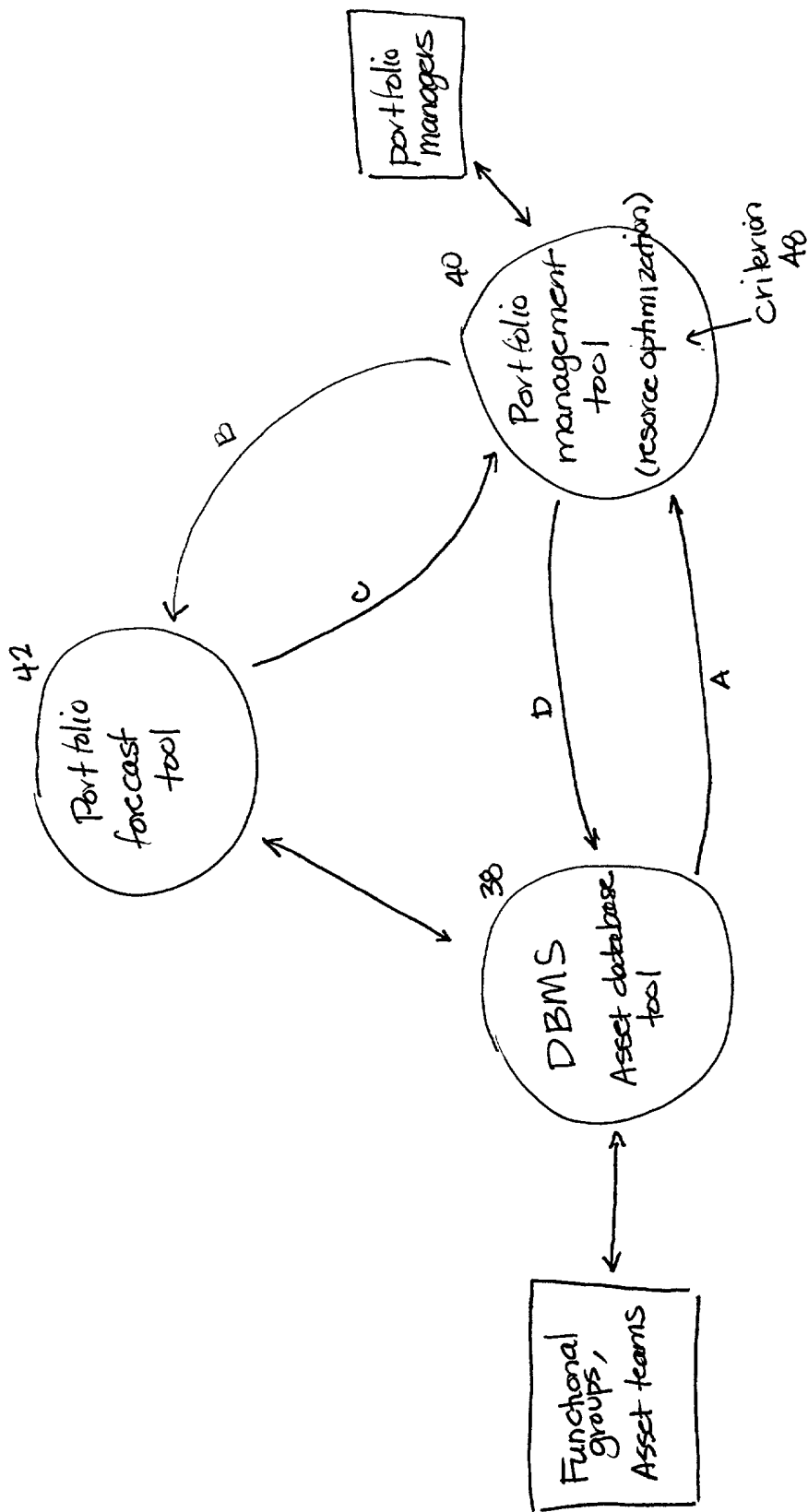
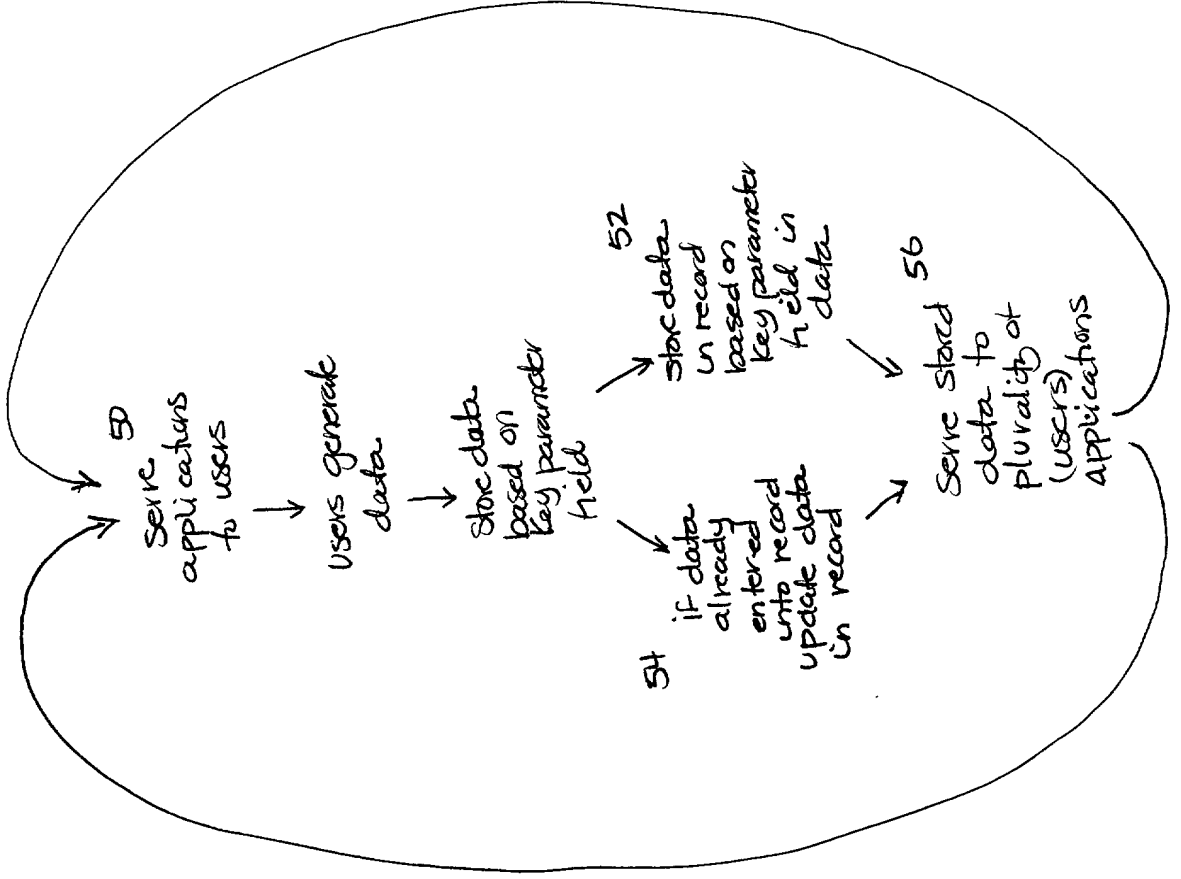


Figure 7

Business information & optimization flow

Figure 8A



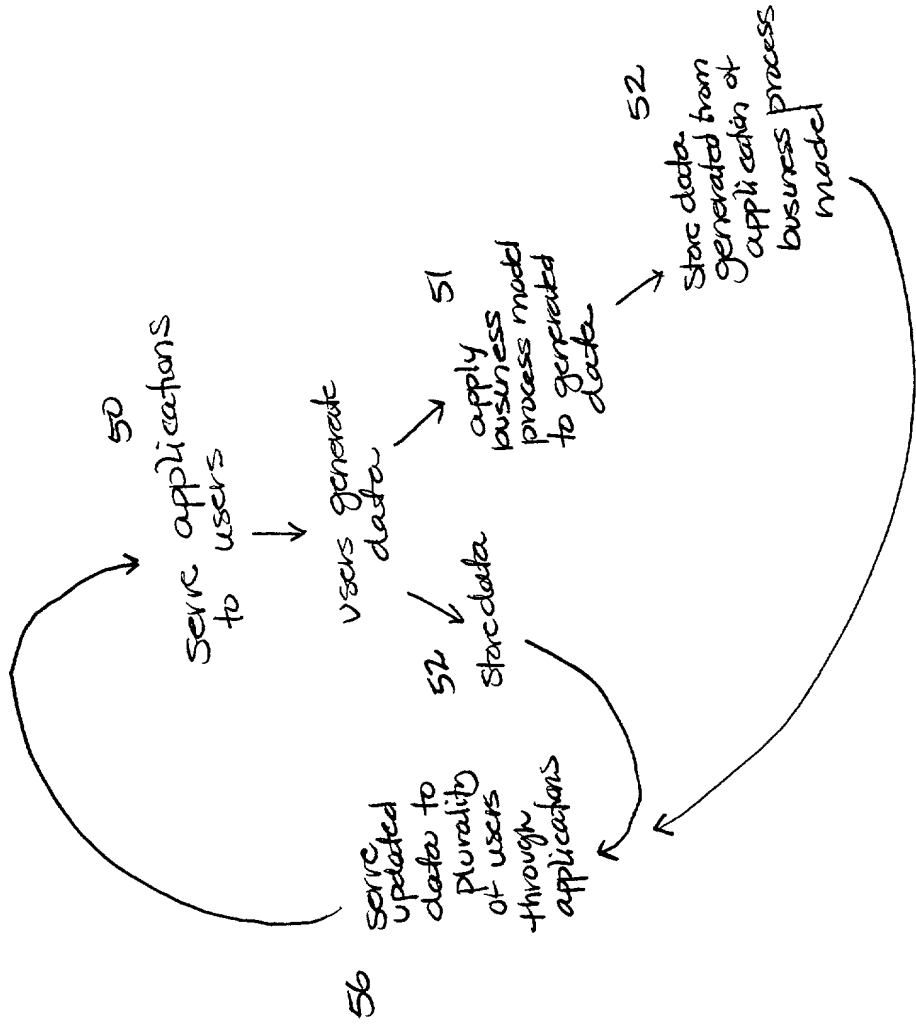


Figure 8B

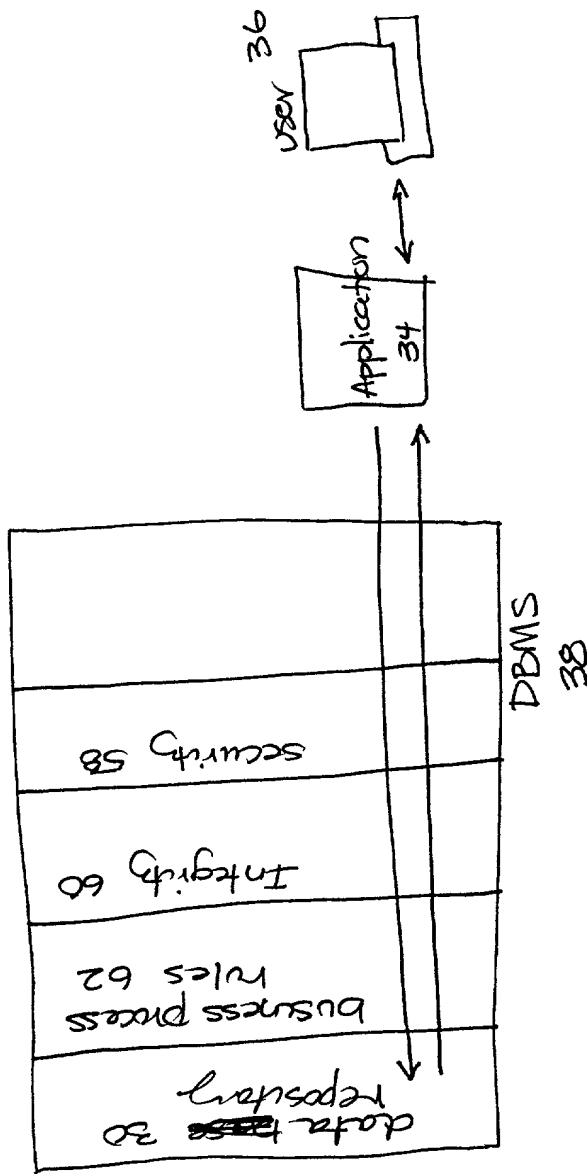


Figure 9

# Asset Team Members & Interactions (for Example)

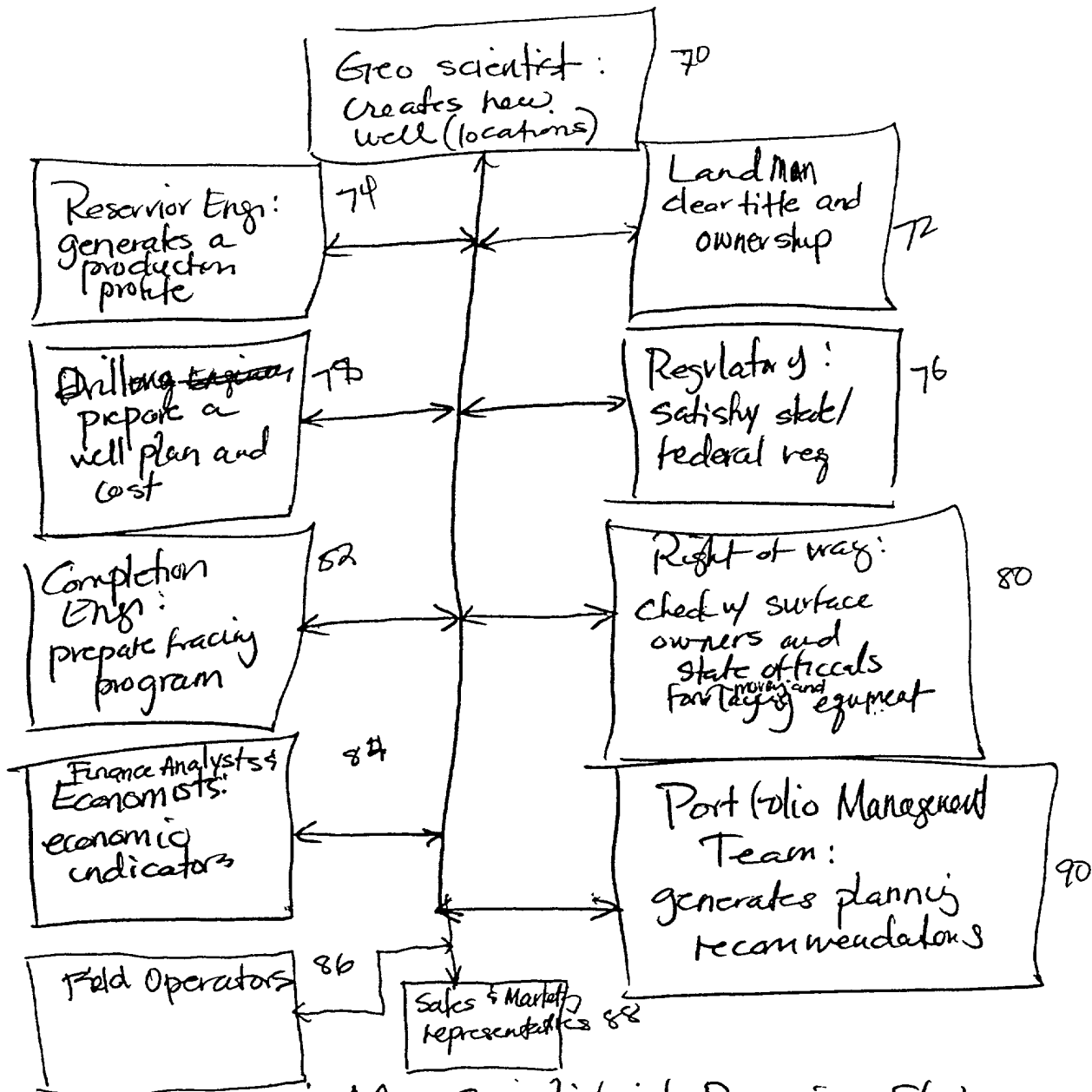


Fig 10: Simplified Business Flow

who get into fm who send info to



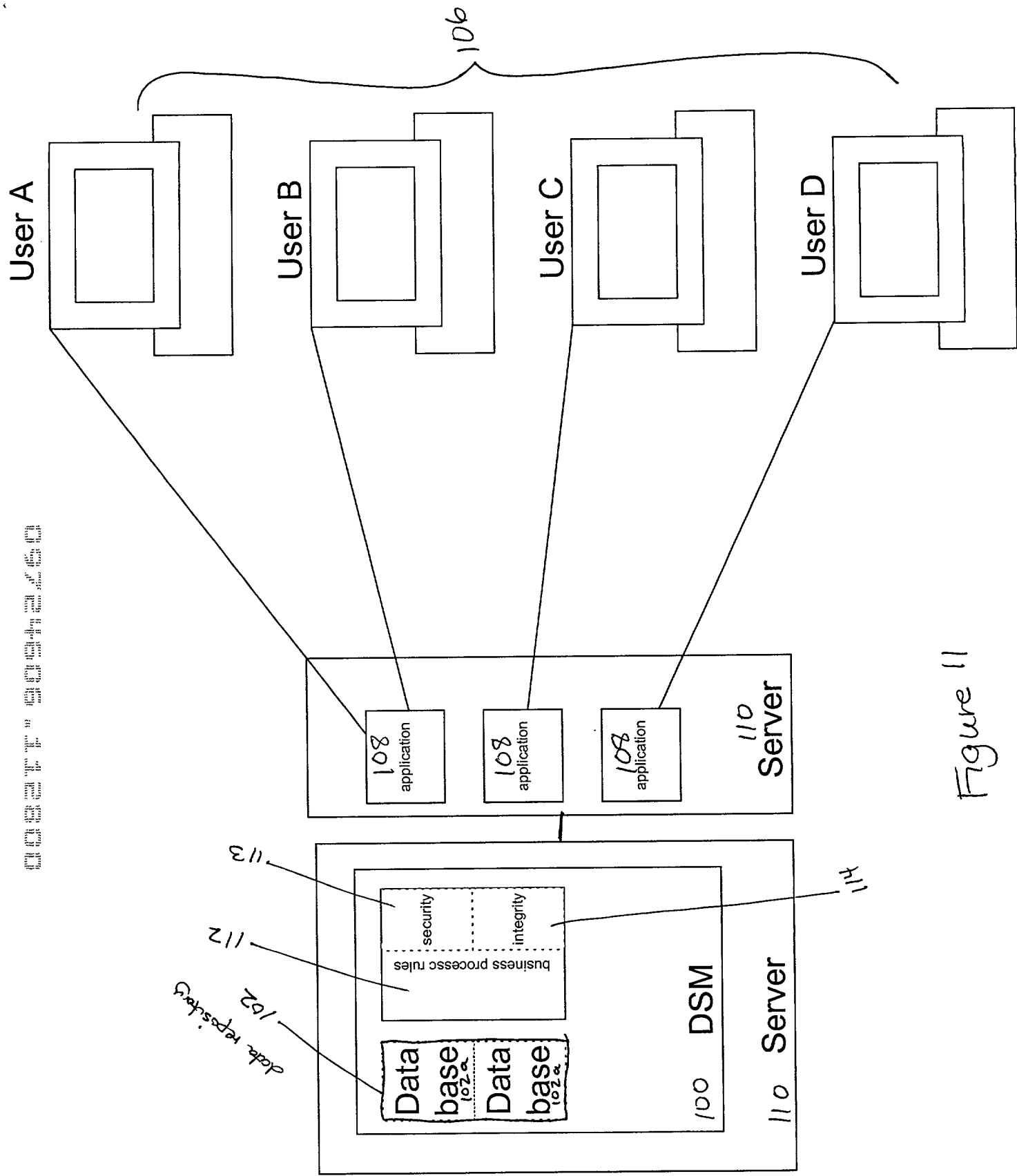


Figure 11

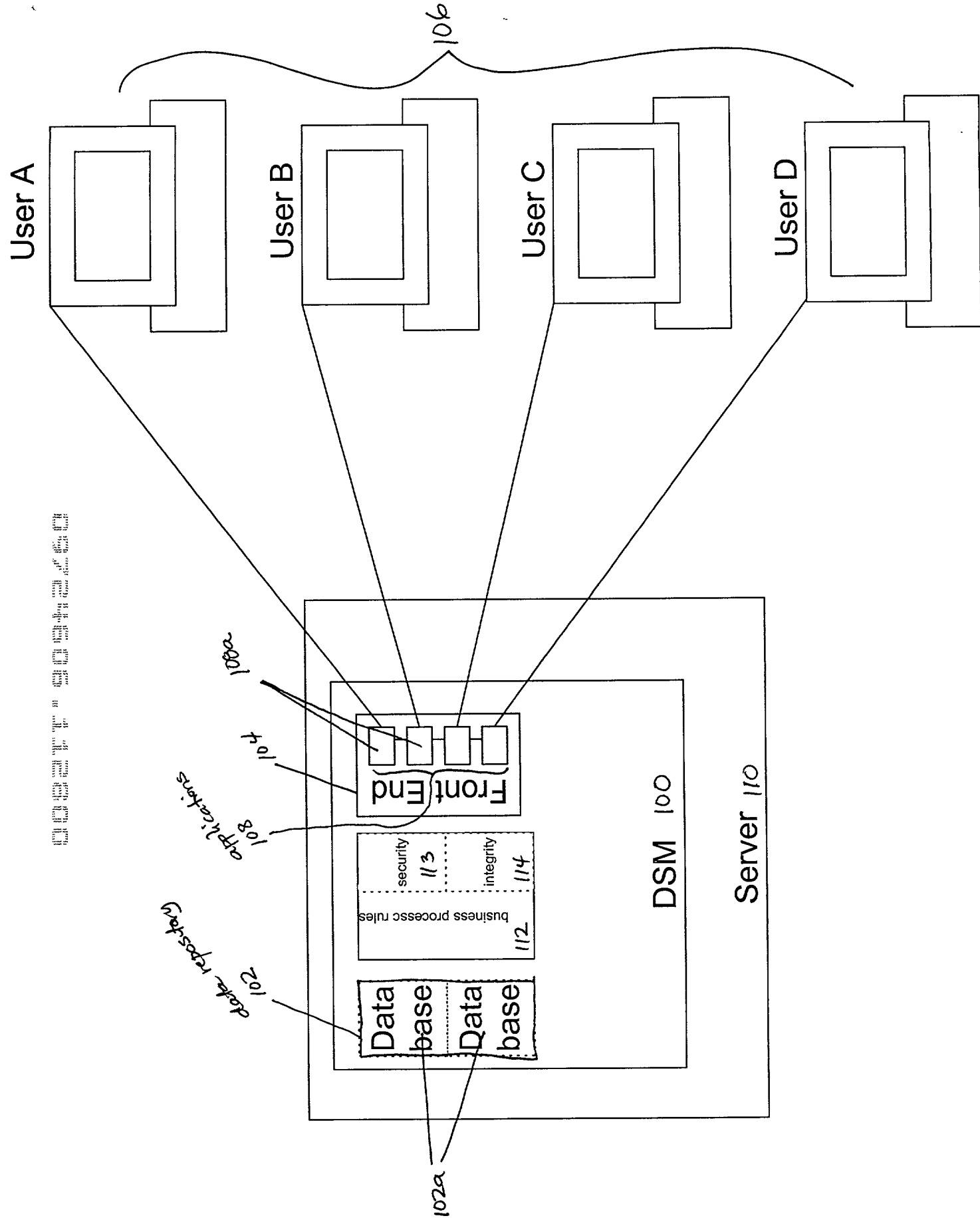


Figure 11A

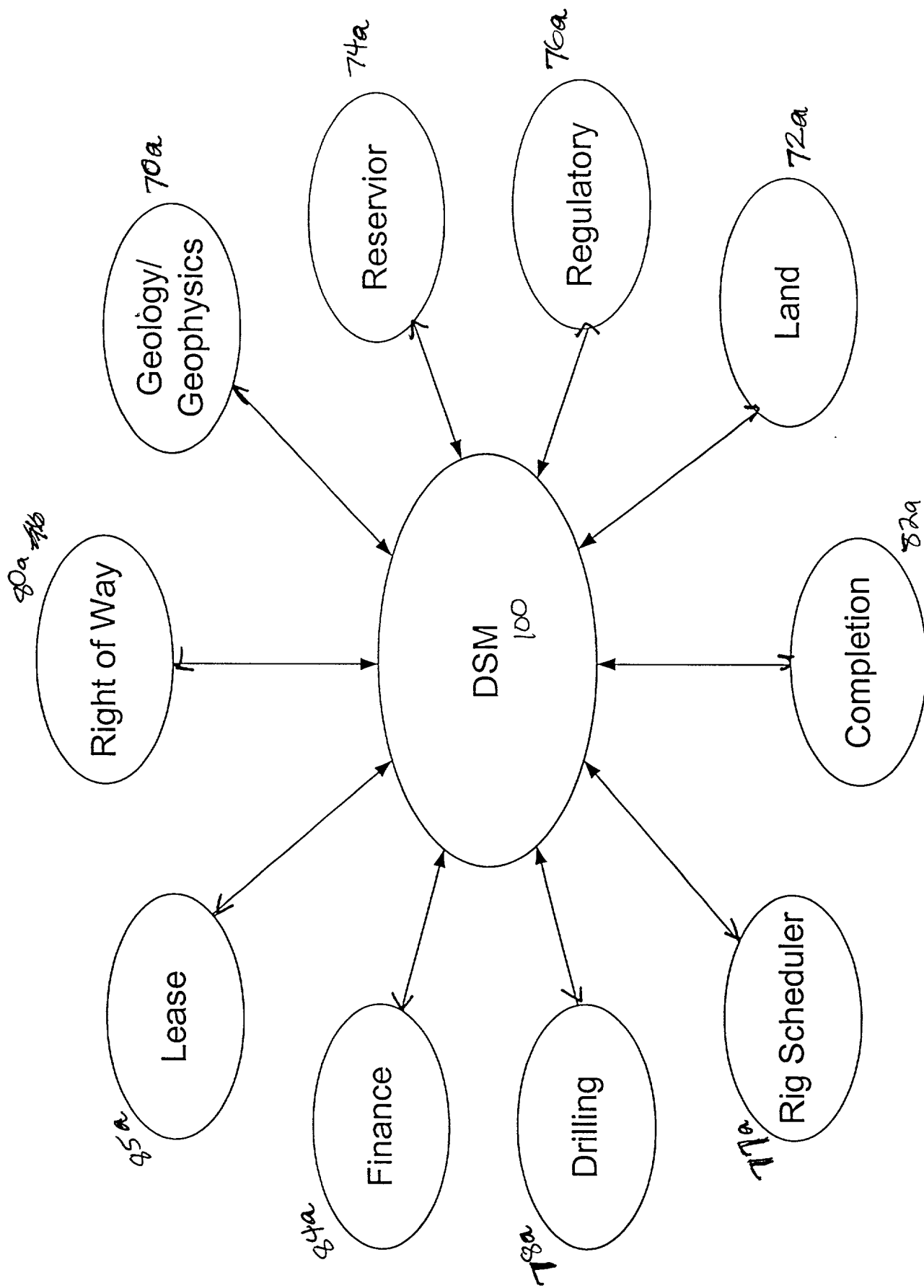


Figure 2

# Key "Links"

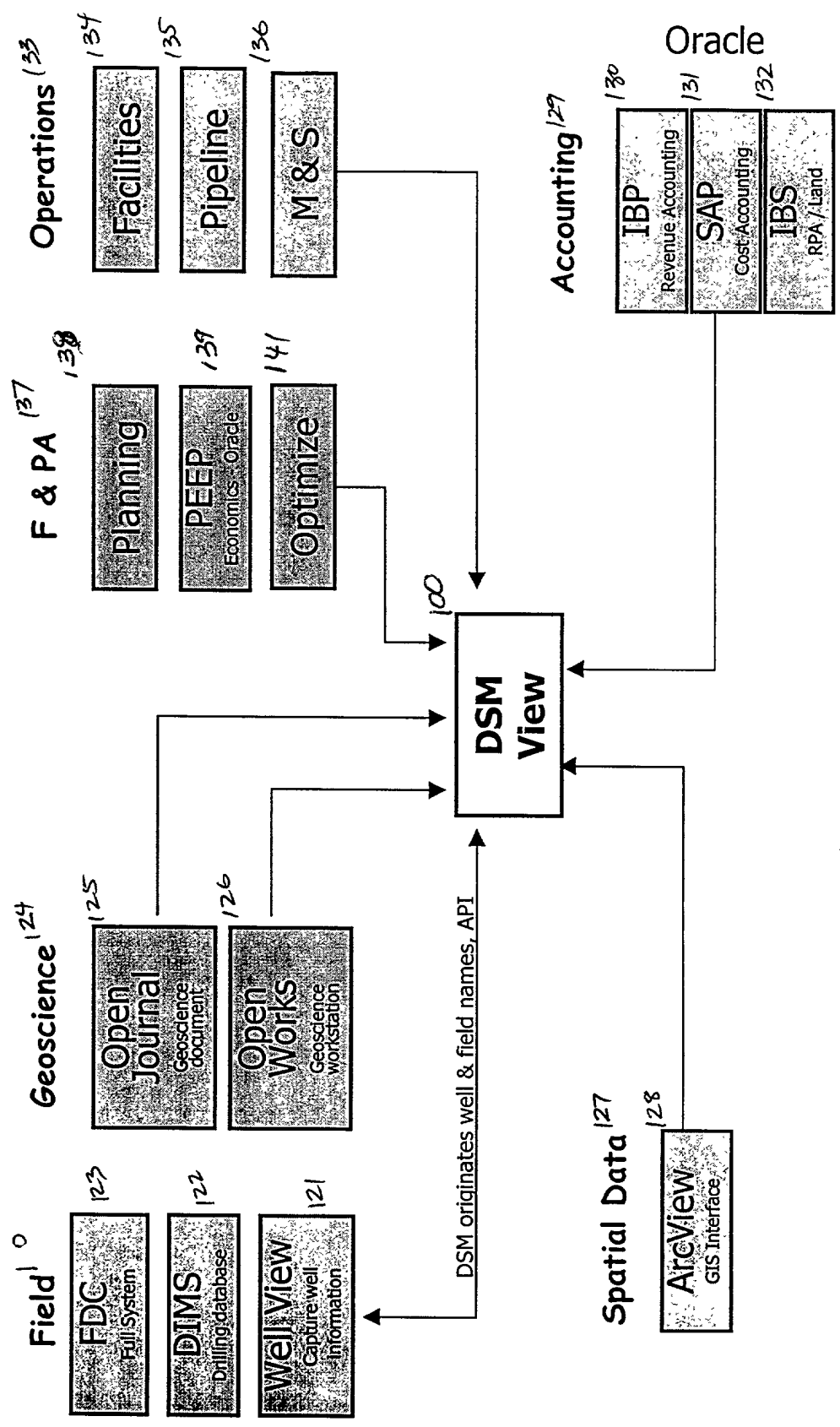


Fig 13

# Pre cast Business Flow

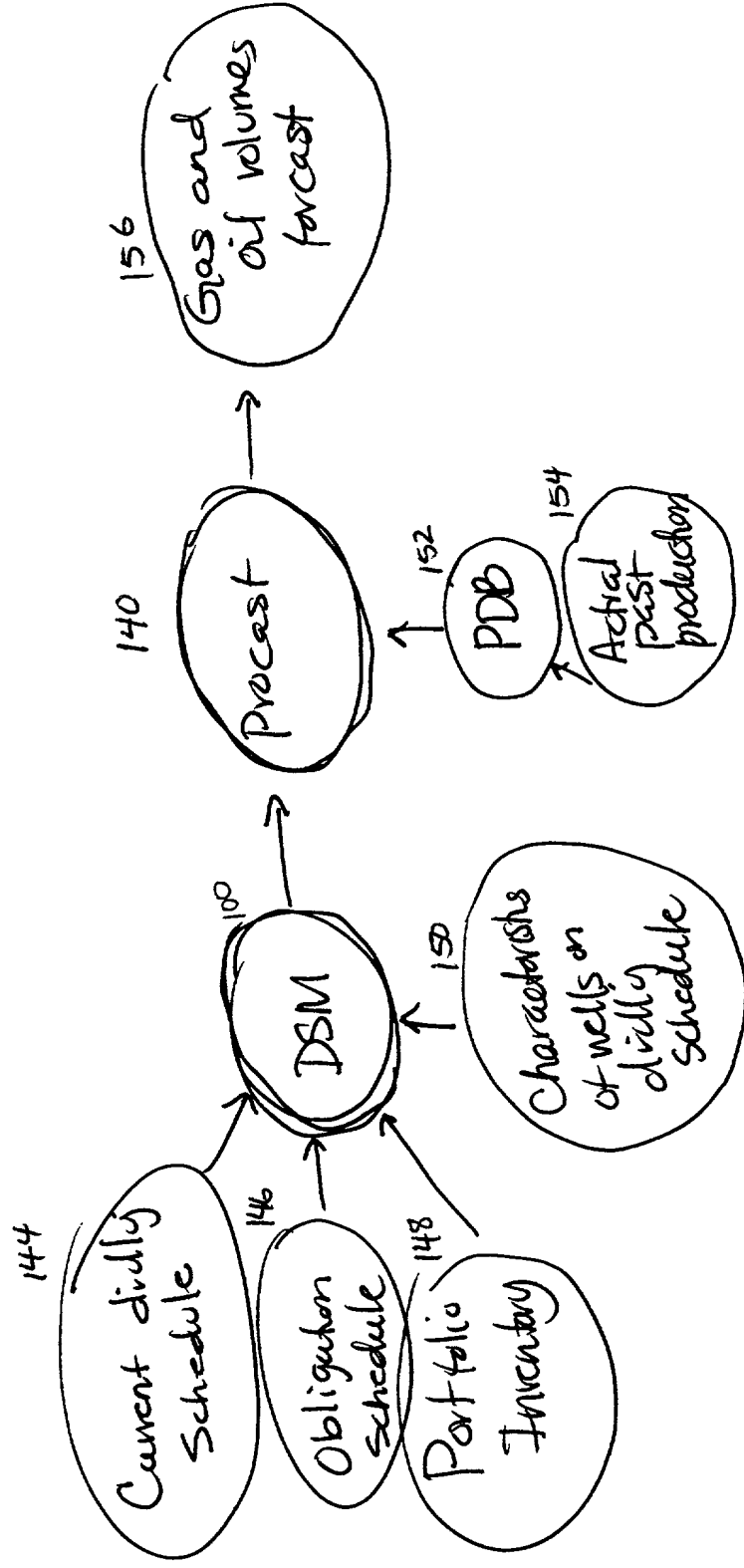


Figure 14

# Optimizer Business Flow

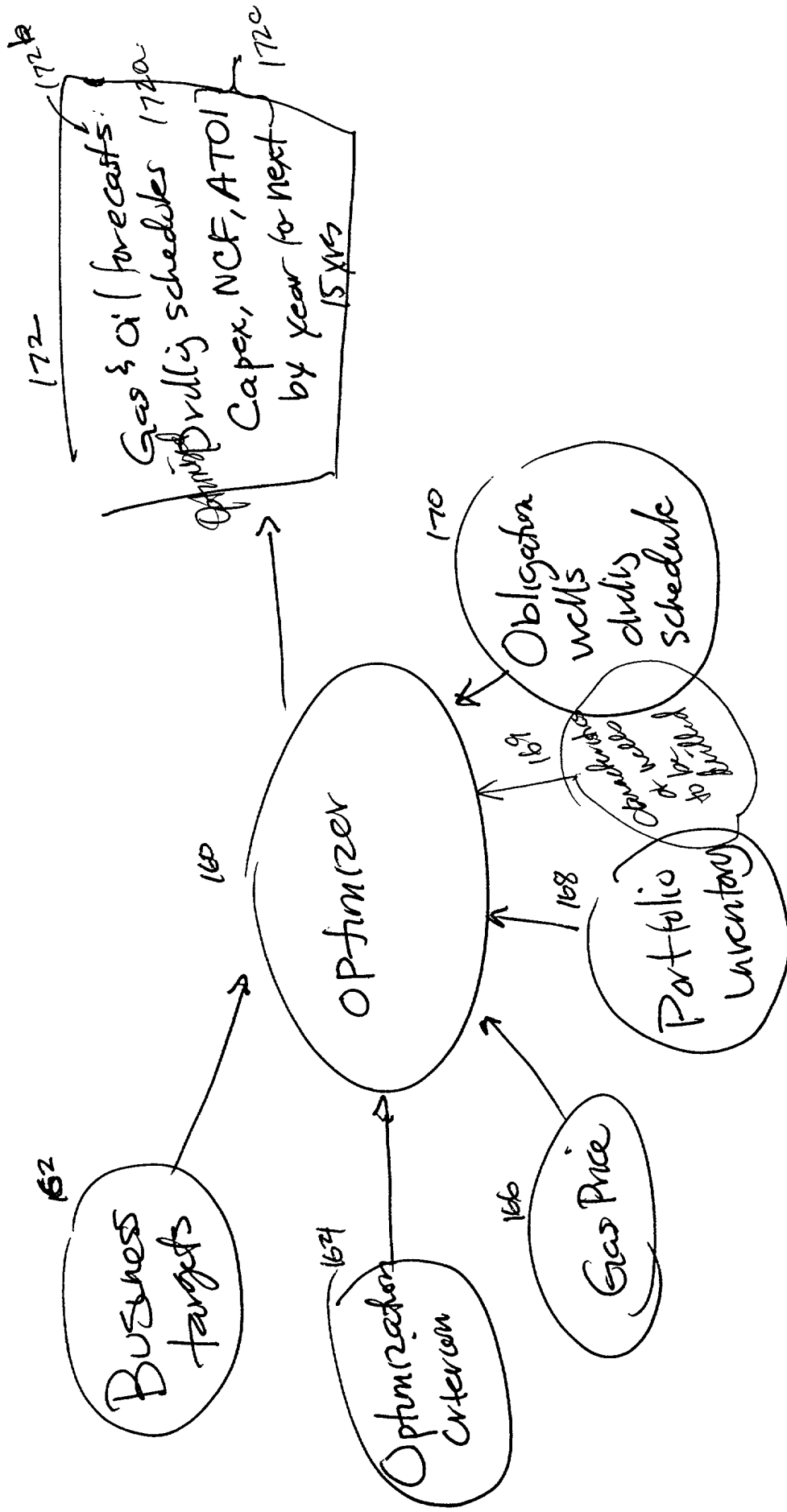
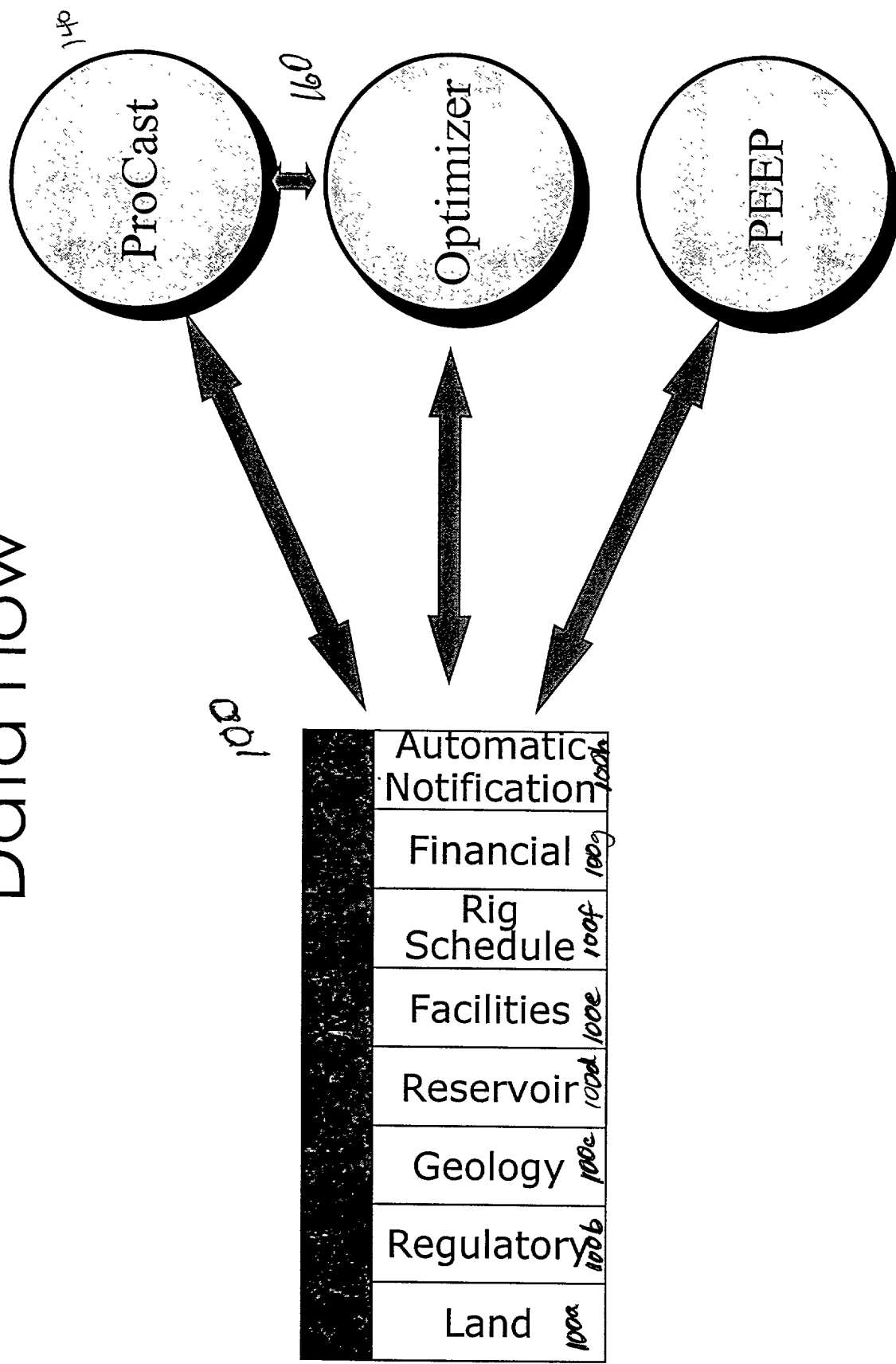


Fig. 15

# Data Flow



OPTIMIZER

Conoco Confidential

Figure 16

# Concept

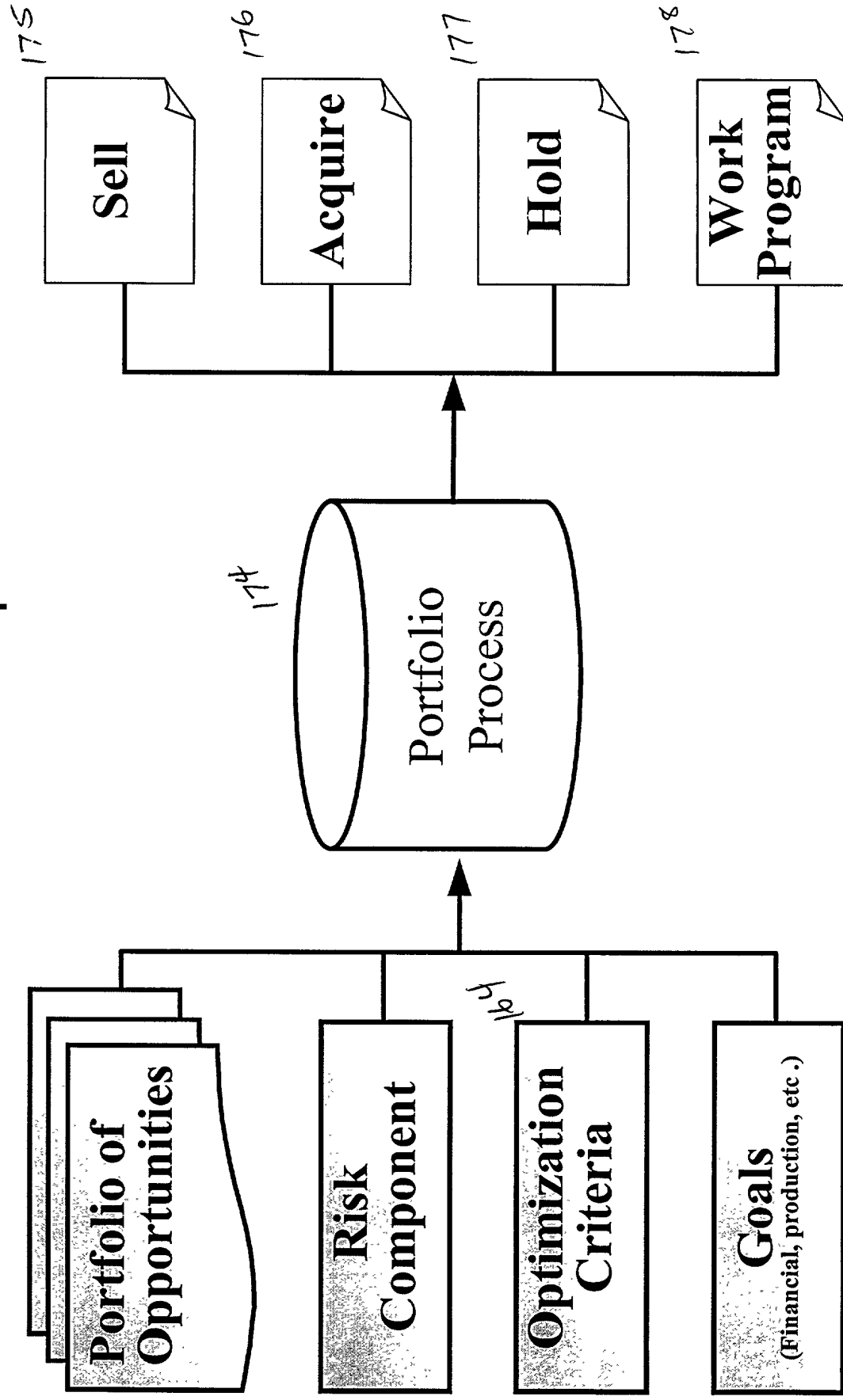


Figure 17



Docket No.  
06558/007002

# Declaration and Power of Attorney For Patent Application

## English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

**INFORMATION MANAGEMENT SYSTEM**



22511

PATENT TRADEMARK OFFICE

the specification of which

(check one)

☒ is attached hereto.

☐ was filed on \_\_\_\_\_ as United States Application No. or PCT International Application Number \_\_\_\_\_ and was amended on \_\_\_\_\_

(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

Priority Not Claimed

_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	<input type="checkbox"/>
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	<input type="checkbox"/>
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60/235,539	September 26, 2000
(Application Serial No.)	(Filing Date)
(Application Serial No.)	(Filing Date)
(Application Serial No.)	(Filing Date)

(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

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Full name of fourth inventor, if any	
Fourth inventor's signature	Date
Residence	
Citizenship	
Post Office Address	

Full name of fifth inventor, if any	
Fifth inventor's signature	Date
Residence	
Citizenship	
Post Office Address	

Full name of sixth inventor, if any	
Sixth inventor's signature	Date
Residence	
Citizenship	
Post Office Address	

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**06558/007002**

Serial No.

Filing Date

Examiner

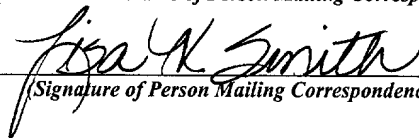
Group Art Unit

Invention: **INFORMATION MANAGEMENT SYSTEM**

I hereby certify that the following correspondence:

**Utility Patent Application***(Identify type of correspondence)*

is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 in an envelope addressed to: The Assistant Commissioner for Patents, Washington, D.C. 20231 on

November 28, 2000*(Date)*Lisa H. Smith*(Typed or Printed Name of Person Mailing Correspondence)**(Signature of Person Mailing Correspondence)*EL656800405US*("Express Mail" Mailing Label Number)***Note: Each paper must have its own certificate of mailing.**